

# Encyclopedia of emergent particles in three-dimensional crystals

Zhi-Ming Yu,<sup>1,\*</sup> Zeyang Zhang,<sup>2,\*</sup> Gui-Bin Liu,<sup>1</sup> Weikang Wu,<sup>3</sup>  
Xiao-Ping Li,<sup>1</sup> Run-Wu Zhang,<sup>1</sup> Shengyuan A. Yang,<sup>3</sup> and Yugui Yao<sup>1,†</sup>

<sup>1</sup>*Key Lab of Advanced Optoelectronic Quantum Architecture and Measurement (MOE),  
Beijing Key Lab of Nanophotonics & Ultrafine Optoelectronic Systems,  
and School of Physics, Beijing Institute of Technology, Beijing 100081, China*

<sup>2</sup>*College of Mathematics and Physics, Beijing University of Chemical Technology, Beijing 100029, China*

<sup>3</sup>*Research Laboratory for Quantum Materials, Singapore University of Technology and Design, Singapore 487372, Singapore*

The past decade has witnessed a surge of interest in exploring emergent particles in condensed matter systems. Novel particles, emerged as excitations around exotic band degeneracy points, continue to be reported in real materials and artificially engineered systems, but so far, we do not have a complete picture on all possible types of particles that can be achieved. Here, via systematic symmetry analysis and modeling, we accomplish a complete list of all possible particles in time-reversal-invariant systems. This includes both spinful particles such as electron quasiparticles in solids, and spinless particles such as phonons or even excitations in electric-circuit and mechanical networks. We establish detailed correspondence between the particle, the symmetry condition, the effective model, and the topological character. This obtained encyclopedia concludes the search for novel emergent particles and provides concrete guidance to achieve them in physical systems.

Unlike elementary particles in high energy physics which are strongly constrained by the Poincaré symmetry, the emergent particles in condensed matters only need to respect much smaller subgroups of the Poincaré symmetry—the crystal space group symmetries [1]. It follows that the emergent particles can have much richer types and dramatically different properties [2–10]. For example, besides the elementary Weyl, Dirac and Majorana type fermions, electron quasiparticles in solids, as emerged around certain band degeneracy points, can exhibit a variety of pseudospin structures [5, 11–13], dispersion types [14–17], topological charges [18–20], and their distribution in momentum space can form manifolds of various topologies [21–25]. The study has also been extended to bosons like phonons, photons and magnons [26–29], and excitations in artificial periodic systems like electric circuit arrays and mechanical networks [30–32].

A central task of the field is to classify all possible emergent particles for each space group. So far, most works are case-by-case type studies, focusing on a specific material or a specific type of emergent particle [33–39]. There do exist a few systematic attempts [5, 40–43]. For example, Bradlyn *et al.* classified emergent fermions beyond Weyl and Dirac types at high-symmetry points in the Brillouin zone (BZ) in the presence of spin-orbit coupling (SOC) and time reversal symmetry [5]. And based on the theory of symmetry indicators, thousands of topological semimetal materials have been identified [44–46], which possess nontrivial emergent fermions. However, the grand task is still far from being accomplished: the emergent particles not at high-symmetry points (like those on high-symmetry lines) as well as the classification

of spinless particles (as appropriate for the large class of bosonic and artificial systems) have not been systematically explored; and while the symmetry indicators are most useful for characterizing gapped phases, they do not give direct classification of the emergent particles.

In this work, we address this challenging task by offering a complete classification of both spinful and spinless emergent particles for three-dimensional (3D) systems with time reversal symmetry. The classification is done for each of the 230 space groups, namely, for a given group, we identify all possible (spinful and spinless, essential and accidental) emergent particles that can appear. Based on this, we obtain a comprehensive list of emergent particles, including 19 types of spinless particles and 23 types of spinful particles (see Table I), along with the space groups that can host them (see Supplemental Material (SM) [47]). Furthermore, for each type of emergent particles, we provide its  $k \cdot p$  effective model, which characterizes the emergent particle (including its topological charge) and serves as the starting point for any subsequent studies of its properties.

Essentially, the results of this work constitute an encyclopedia of emergent particles in condensed matter, which is not only of fundamental significance but also highly useful for various purposes. For example, for any given system, such as electronic band structure or phonon spectrum of a specific material, the characterization of any spotted emergent particles can be done by directly looking up our table. The provided effective models can be directly utilized to fit the experimental or first-principles spectra and to study the system properties. Meanwhile, one can also search for a particular type of particle in concrete systems with the guidance of our table. Besides realistic materials, this could be especially useful for realizing spinless emergent particles in artificial systems, which can be precisely engineered and probed

\* Z. M. Yu and Z. Zhang contributed equally to this work.

† ygyao@bit.edu.cn

with current technology.

*Rationale.* We first describe the working procedure that leads to our results. As mentioned, the novel particles emerge around band degeneracy points. The classification of emergent particles is therefore equivalent to the classification of all possible band degeneracies. Any stable degeneracy must require certain protection. For spatially periodic systems, the protection comes from the space group symmetries with the action on the BZ. In this work, we consider the systems with time reversal symmetry  $\mathcal{T}$ , so the relevant symmetries are the 230 so-called type-II magnetic space groups  $\mathcal{M} = \mathcal{G} + \mathcal{T}\mathcal{G}$  [1], where  $\mathcal{G}$  is the crystallographic space group. With the exception of Weyl points which only requires the translational subgroup and can be topologically protected at generic  $\mathbf{k}$  points, all other types of degeneracies will require a nontrivial little group at the corresponding  $\mathbf{k}$  points [4]. The little group  $M^{\mathbf{k}_1}$  at point  $\mathbf{k}_1$  takes the form of either

$$M^{\mathbf{k}_1} = G^{\mathbf{k}_1}, \quad (1)$$

or

$$M^{\mathbf{k}_1} = G^{\mathbf{k}_1} + \mathcal{A}G^{\mathbf{k}_1}, \quad (2)$$

where  $G^{\mathbf{k}_1}$  is the corresponding crystallographic little group and  $\mathcal{A}$  is certain anti-unitary operator. The band degeneracies are associated with the irreducible representations (IRs) of the group  $M^{\mathbf{k}_1}$  [1]. At high-symmetry points of the BZ, band degeneracies correspond to the IRs with dimensions  $n > 1$ . At high-symmetry lines, band degeneracies may involve nodal lines which correspond to IRs with  $n > 1$ , or nodal points which correspond to the crossing of bands with different IRs. Similarly, at high-symmetry planes, the generic degeneracies are the nodal surfaces corresponding to IRs with  $n > 1$ , and nodal lines corresponding to two different IRs.

Hence, to obtain the possible band degeneracies for each space group  $\mathcal{M}$ , we first find its little groups for all high-symmetry points, lines, and planes. Then for each little group, we find its matrix IRs. For  $M^{\mathbf{k}_1}$  having the form of Eq. (1), the matrix IRs are available in Ref. [1]. For the cases in (2), the representations (known as corepresentations) can be derived from those of  $G^{\mathbf{k}_1}$  whenever  $\mathcal{A}$  is known. This is discussed in detail in SM [47]. Our obtained complete list of the single-valued (for spinless particles) and double-valued (for spinful particles) matrix representations for the little groups of the 230 space groups are presented in Sec. S7A and S8A of SM [47], respectively. Based on this information, we find all possible band degeneracies, and we characterize the emergent particles around these degeneracies by constructing the  $k \cdot p$  effective models. The model Hamiltonian  $\mathcal{H}_{\mathbf{k}_1}$  expanded at the degeneracy point  $\mathbf{k}_1$  is solved from the constraint equations

$$D(\mathcal{O}_i)\mathcal{H}_{\mathbf{k}_1}(\mathbf{q})[D(\mathcal{O}_i)]^{-1} = \mathcal{H}_{\mathbf{k}_1}(\hat{\mathcal{O}}_i\mathbf{q}), \quad (3)$$

where  $\mathcal{O}_i$  runs through the generators of the little group,  $D(\mathcal{O}_i)$  denotes its matrix representation at the considered band degeneracy, and  $\mathbf{q}$  is the momentum measured from  $\mathbf{k}_1$ . With the help of the effective models, we can classify the emergent particles by the dimension of degeneracy manifold, the degree of degeneracy, the type of dispersion, and the topological charge, as in Table I. The list of all possible emergent particles along with their effective models for each space group is presented in Sec. S7 and S8 of SM [47].

We have two remarks before proceeding. First, certain degeneracies at high-symmetry points (lines) may not be isolated nodal points, instead, they could be residing on a higher-dimensional degeneracy manifold (nodal lines or surfaces). The effective models are helpful for distinguishing such cases.

Second, nodal lines may form various connection patterns in the BZ, such as nodal chains, crossed nodal loops, nodal boxes, and etc [21, 23, 48]. Such connectivity cannot be directly inferred from the effective modeling which is valid locally in BZ. Hence, in this work, we do not make a differentiation based on the connectivity for multiple nodal lines, but refer to them collectively as nodal-line nets.

*An example: SG 211.* To illustrate the usage of our results, we discuss one concrete example—a spinless system with space group No. 211 (SG 211).

Table II shows the excerpt from our result in Sec. S7 of SM [47] for this group. SG 211 ( $O^5$ ) is a cubic space group with a body-centred cubic Bravais lattice. The first line in Table II presents several basic information, including the BZ type, the symmetry generators (translations are not included here), whether centrosymmetry  $I$  is contained in the group, and whether SOC is considered (i.e., spinful or spinless). Here, the  $I$  symmetry is highlighted, because the presence of  $I$  would lead to a combined  $I\mathcal{T}$  symmetry for every  $\mathbf{k}$  point. For spinless systems, this combined symmetry prevents the existence of Weyl points but can protect Weyl nodal lines [21].

The BZ for SG 211 is illustrated in Fig. 1(a). In Table II, we show the results for high-symmetry points  $\Gamma$  and  $P$ , and high-symmetry line  $\Sigma$  ( $\Gamma N$ ). The results for other  $\mathbf{k}$  points can be found in Sec. S7 of SM [47]. First, let's look at the  $\Gamma$  point. Here, the different pieces of information are separated by the semicolons. After the  $\Gamma$  symbol, we give the coordinate for the  $\Gamma$  point. Then there are the generating elements of the little group at  $\Gamma$ , including five elements  $C_{31}^-$ ,  $C_{2z}$ ,  $C_{2x}$ ,  $C_{2a}$ , and  $\mathcal{T}$ . Here,  $C_{31}^-$  denotes  $C_{3,111}^-$ , and  $C_{2a}$  denotes  $C_{2,110}$  [1]. This little group has five distinct irreducible corepresentations, labelled as  $R_i$  with  $i = 1, 2, \dots, 5$ . (A correspondence between  $R_i$  and the band-representation notations can be found in Refs. [1, 49].) The number following  $R_i$  gives the dimension of  $R_i$ . Here, one observes that  $R_1$  and  $R_2$  are 1d representations,  $R_3$  gives a twofold degeneracy, and  $R_4$  and  $R_5$  represent threefold degeneracies. After

TABLE I. Notation of the emergent particles listed in this work. Abbr. indicates the abbreviation of notation,  $d_c$  and  $d$  indicates the dimensionality and degeneracy of the particles, Ld indicates the leading order of the band splitting of particles in BZ, and  $\mathcal{C}$  indicates the maximum topological charge of the particles. The possible Hamiltonian and typical band structure of the emergent particles are given in Sec. S3 of SM [47].

Notation	Abbr.	$d_c$	$d$	Ld	$ \mathcal{C} $	Realization	
						w/o SOC	with SOC
Charge-1 Weyl point	C-1 WP	0	2	(111)	1	✓	✓
Charge-2 Weyl point	C-2 WP	0	2	(122)	2	✓	✓
Charge-3 Weyl point	C-3 WP	0	2	(133)	3	✓	✓
Charge-4 Weyl point	C-4 WP	0	2	(223)	4	✓	×
Triple point	TP	0	3	(111)		✓	✓
Charge-2 triple point	C-2 TP	0	3	(111)	2	✓	✓
Quadratic triple point	QTP	0	3	(122)		✓	×
Quadratic contact triple point	QCTP	0	3	(222)	0	✓	×
Dirac point	DP	0	4	(111)	0	✓	✓
Charge-2 Dirac point	C-2 DP	0	4	(111)	2	✓	✓
Charge-4 Dirac point	C-4 DP	0	4	(111)	4	×	✓
Quadratic Dirac point	QDP	0	4	(122)	0	✓	✓
Charge-4 quadratic Dirac point	C-4 QDP	0	4	(122)	4	×	✓
Quadratic contact Dirac point	QC DP	0	4	(222)	0	✓	✓
Cubic Dirac point	CDP	0	4	(133)	0	×	✓
Sextuple point	SP	0	6	(111)	0	✓	✓
Charge-4 sextuple point	C-4 SP	0	6	(111)	4	×	✓
Quadratic contact sextuple point	QCSP	0	6	(222)	0	×	✓
Octuple point	OP	0	8	(111)	0	×	✓
Weyl nodal line	WNL	1	2	(11)	$\pi$	✓	✓
Weyl nodal-line net	WNL net	1	2	(11)	$\pi$	✓	✓
Quadratic nodal line	QNL	1	2	(22)	0	✓	✓
Cubic nodal line	CNL	1	2	(33)	$\pi$	×	✓
Dirac nodal line	DNL	1	4	(11)	0	✓	✓
Dirac nodal-line net	DNL net	1	4	(11)	0	✓	✓
Nodal surface	NS	2	2	(1)	1	✓	✓

that, the matrix representations of the five generating elements are given. Here, the  $\sigma$ 's (for  $R_3$ ) are the Pauli matrices, and the  $A$ 's (for  $R_4$  and  $R_5$ ) are  $3 \times 3$  matrices defined in Sec. S6B in SM [47]. Note that the complex conjugation operator  $\mathcal{K}$  in the anti-unitary element  $\mathcal{T}$  is not explicitly written out in the table. The next column

shows the effective model constructed according to Eq. (3) based on each matrix representation. For example, the emergent particles around the double degeneracy of

TABLE II. Part of the single-valued corepresentation of SG 211, including both the essential and accidental degeneracies. At the top, the columns from left to right list the high-symmetry momentum  $\mathbf{k}$ , the position of  $\mathbf{k}$ , the generating elements of the little group of  $\mathbf{k}$ , the irreducible representation of little group of  $\mathbf{k}$ , the dimension of the representation, the matrix representations of the generating elements, and the effective Hamiltonian, the species and the topological charge of the degeneracies. The bottom part lists the accidental degeneracy.

SG 211

$\Gamma_c^-; \{C_{31}^- 000\}, \{C_{2z} 000\}, \{C_{2x} 000\}, \{C_{2a} 000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$									
$\Gamma; (000);$	$C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$							
		$R_2; 1; 1, 1, 1, -1, 1;$							
		$R_3; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, \sigma_0;$		$(c_1 + c_2 k^2)\sigma_0 + c_3 k_x k_y k_z \sigma_2$		C-4 WP; 4			
				$+c_4 [\sqrt{3}(k_x^2 - k_y^2)\sigma_1 + (k^2 - 3k_z^2)\sigma_3];$					
		$R_4; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, A_{12}, A_0;$		$A_0 c_1 + c_2 (A_3 k_x - A_2 k_y + A_1 k_z);$		C-2 TP; 2			
		$R_5; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, A_0;$		$A_0 c_1 + c_2 (A_3 k_x - A_2 k_y + A_1 k_z);$		C-2 TP; 2			
$P; (\frac{1}{4}, \frac{1}{4}, \frac{1}{4});$	$C_{31}^+, C_{2z}, C_{2y}, C_{2c} \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$							
		$R_2; 1; (-1)^{2/3}, 1, 1, 1, 1;$							
		$R_3; 1; (-1)^{4/3}, 1, 1, 1, 1;$							
		$R_4; 3; A_9, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, A_{15};$		$c_1 A_0 + c_2 (A_7 k_x + A_6 k_y + A_4 k_z)$		C-2 TP; 2			
				$+c_3 (A_3 k_x - A_2 k_y + A_1 k_z);$					
$\Sigma; \Gamma N;$	$C_{2a}, C_{2b} \mathcal{T};$	$R_1; 1; 1, 1, 1;$							
		$R_2; 1; -1, 1, 1;$							

Accidental degeneracies on high-symmetry line

$\Sigma; \Gamma N; C_{2a}, C_{2b} \mathcal{T}; \{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_x - k_y);$	C-1 WP; 1
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$R_3$  are described by

$$\mathcal{H}_{\text{C-4 WP}} = (c_1 + c_2 k^2)\sigma_0 + c_3 k_x k_y k_z \sigma_2 + c_4 [\sqrt{3}(k_x^2 - k_y^2)\sigma_1 + (k^2 - 3k_z^2)\sigma_3], \quad (4)$$

where the  $c$ 's are real model parameters. Interestingly, from the effective model (4), one finds that the dispersion of the emergent particle is cubic along the (111) direction and quadratic in the plane perpendicular to (111). Furthermore, the nodal point carries a large topological charge (Chern number)  $\mathcal{C} = \pm 4$ , hence it is named as a charge-4 Weyl point (C-4 WP). Here, we follow the convention to use Weyl/Dirac to denote twofold/fourfold degeneracy. Notably, the dispersion and the topological charge of this C-4 WP are distinct from the previously known multi-Weyl points [18], which invariably have a direction with linear dispersion and have topological charges less than 4. In addition, we find that C-4 WP can only exist in spinless systems. As shown Sec. S2 in SM [47], it can appear in space groups with  $T$  or  $O$  point groups, including space group No. 195-199 and 207-214. The type of the band degeneracy and the topological charge are presented in the last two columns in Table II.

From Table II, one can see that  $R_4$  and  $R_5$  at  $\Gamma$  both

give a charge-2 triple point (C-2 TP), i.e., a threefold nodal point with topological charge  $\pm 2$ . This type of nodal point also can appear for the  $R_4$  representation at  $P$ . As summarized in Sec. S2 in SM [47], C-2 TP can appear in both spinless and spinful systems. However, it only occurs at non- $\mathcal{T}$ -invariant momenta for the spinful systems, while it can occur at both  $\mathcal{T}$ -invariant and non- $\mathcal{T}$ -invariant momenta for spinless systems.

The similar analysis is performed for the high-symmetry line  $\Sigma$ . The little group at  $\Sigma$  has two distinct irreducible representations  $R_1$  and  $R_2$ . These are 1d representations, indicating that there is no essential degeneracy along the  $\Sigma$  line. However, there could exist an accidental degeneracy formed by crossing between  $R_1$  and  $R_2$  bands, as described in the last row in Table II. The effective model for this accidental crossing is constrained by

$$\Delta(\mathcal{O})\mathcal{H}(\mathbf{k})[\Delta(\mathcal{O})]^{-1} = \mathcal{H}(\hat{\mathcal{O}}\mathbf{k}), \quad (5)$$

where  $\mathcal{O} \in \{C_{2a}, C_{2b} \mathcal{T}\}$  ( $C_{2b}$  denotes  $C_{2, \bar{1}10}$ ) is one of the two generators, and  $\Delta(\mathcal{O}) = D_1(\mathcal{O}) \oplus D_2(\mathcal{O})$ , which is  $\sigma_3$  for  $C_{2a}$  and  $\sigma_0 \mathcal{K}$  for  $C_{2b} \mathcal{T}$ . The obtained model in Table II shows that this crossing is a conventional Weyl point with  $|\mathcal{C}| = 1$ .



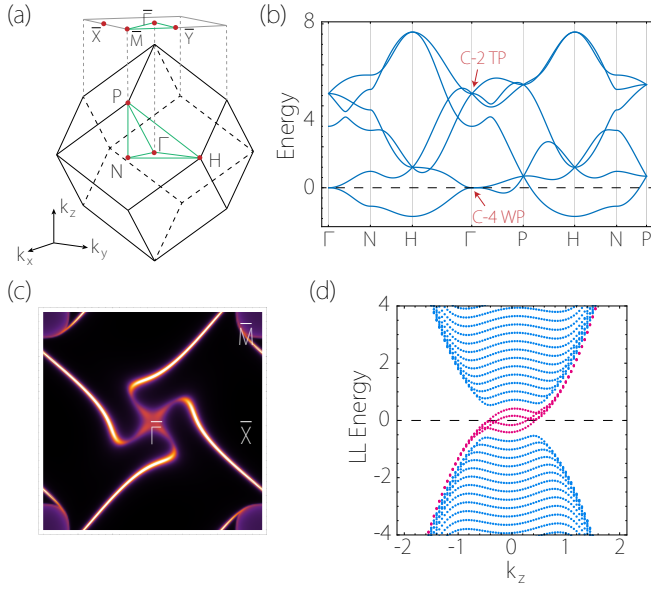


FIG. 1. (a) Bulk and (001) surface BZ of SG 211. (b) The bulk band structure and (c) the Fermi surface contours at  $E_F = 0$  on the (001) surface for a TB model with SG 211. The C-4 WP is located at the  $\Gamma$  point formed by the lowest two bands and it gives four topological Fermi arcs at the surface. For the parameters of TB model see SM [47]. (d) Landau spectrum of C-4 WP (obtained by using the  $k \cdot p$  effective model) with  $B$  field along the  $z$  direction.

**Signatures of emergent particles.** Methods for detecting the emergent particles have been well established. For example, electronic excitations in solid materials can be directly probed by the angle-resolved photoemission spectroscopy (ARPES) [4]. Similar spectroscopy techniques for detecting excitations in photonic, phononic, cold-atom optical lattices, and mechanical systems have also been developed [26–30]. These methods can directly detect the band degeneracy and map out the dispersion for the emergent particles.

Of most interest are the chiral particles in Table I with nontrivial topological charges. For example, let's consider the C-4 WP discussed above for spinless systems with SG 211. To confirm the existence of such a nodal point, we explicitly construct a tight-binding model based on a body-centred cubic lattice with SG 211 (see SM [47]). From the calculated band structure in Fig. 1(b), one finds that at  $\Gamma$ , there exist a twofold nodal point and a threefold nodal point, as indicated by the arrows. By checking Table II (or Sec. S7 in SM), one immediately knows that they correspond to C-4 WP and C-2 TP, respectively. Similarly, the two threefold degeneracies at  $P$  are two C-2 TPs, and the two nodal points at  $H$  are C-4 WP and C-2 TP. The effective models for the emergent particles around these degeneracies can be directly read off from our tables and used to fit the spectrum in Fig. 1(b). This demonstrates the powerfulness

of our established encyclopedia.

Focusing on the C-4 WP, its nontrivial topological charge dictates that at the surface of the system, there must be four Fermi arcs emanating from the projection of the C-4 WP. This is confirmed by the calculation using the tight-binding model, as shown in Fig. 1(c). The topological charge also can manifest in the Landau spectrum [50]. In Fig. 1(d), we consider a magnetic field along the  $z$  direction and plot the Landau spectrum along  $k_z$  around the energy of the C-4 WP (set to be zero here). One clearly observes that there are four chiral Landau bands crossing the zero energy, showing that the original nodal point has a topological charge of 4. Experimentally, the surface Fermi arcs can be probed by scanning tunneling spectroscopy (STS) or ARPES, and the chiral Landau bands can be probed by STS or magneto-infrared spectroscopy.

**Discussion.** In this work, we have systematically investigated all possible spinless and spinful emergent particles protected by space group and time reversal symmetries. With a unified classification scheme and unified notations, a complete characterization is performed for each space group and for each type of emergent particles. This offers an extremely useful toolbox for subsequent studies. For example, the possible emergent particles in a concrete system can be directly checked by looking up our tables in Sec. S7 and S8 of SM [47]. The effective models there provide a starting point for understanding the system properties. Using Tables in Sec. S2 of SM [47], one can search for a specific type of particles in material database (with the detailed guidance regarding the location in BZ and the band symmetry). Recently, several high-throughput computation works have searched over all stable non-magnetic solid materials [44–46], resulting in thousands of possible topological semimetals. However, the detailed characterization of the emergent particles is lacking. It will be important to make a cross-reference between our encyclopedia and that list of materials, which helps to fully characterize all existing realistic materials. Particularly, some of us have established a SpaceGroupRep package [49] to analyze the band representation based on the notation of Ref. [1], which greatly facilitates the study. Probably the more intriguing application of our result is in the design of artificial systems with novel emergent particles. For example, the photonic and acoustic crystals can be well controlled with current technology. With the guidance of the encyclopedia, any spinless particles can be readily realized in these systems.

Our approach here can be extended to systems with broken time reversal symmetry, namely, the so-called type-III and type-IV magnetic space groups. And it can be extended to systems with additional particle-hole symmetry or chiral symmetry, which appear, e.g., in superfluids and superconductors. Adding such symmetries will change the classification in a fundamental way. For example, a type of  $\mathbb{Z}_2$ -charged nodal surfaces with variable

shapes can exist for spinless systems with chiral symmetry [25]; but without this symmetry, we find that nodal surfaces can only exist at certain boundary planes of the BZ (see Sec. S2 of SM [47]).

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# Supplemental Material for “Encyclopedia of emergent particles in three-dimensional crystals”

Zhi-Ming Yu,<sup>1,\*</sup> Zeyang Zhang,<sup>2,\*</sup> Gui-Bin Liu,<sup>1</sup> Weikang Wu,<sup>3</sup>  
Xiao-Ping Li,<sup>1</sup> Run-Wu Zhang,<sup>1</sup> Shengyuan A. Yang,<sup>3</sup> and Yugui Yao<sup>1,†</sup>

<sup>1</sup>*Key Lab of Advanced Optoelectronic Quantum Architecture and Measurement (MOE),  
Beijing Key Lab of Nanophotonics & Ultrafine Optoelectronic Systems,  
and School of Physics, Beijing Institute of Technology, Beijing 100081, China*

<sup>2</sup>*College of Mathematics and Physics, Beijing University of Chemical Technology, Beijing 100029, China*

<sup>3</sup>*Research Laboratory for Quantum Materials, Singapore University of Technology and Design, Singapore 487372, Singapore*

## CONTENTS

S1. Derivation of lattice model with SG 211	5
S2. Quantitative mapping between emergent particles and type-II MSGs	6
S3. Emergent particles in 3D crystals	8
A. Charge-1 Weyl point	8
B. Charge-2 Weyl point	8
C. Charge-3 Weyl point	8
D. Charge-4 Weyl point	9
E. Triple point	9
F. Charge-2 Triple point	10
G. Quadratic triple point	10
H. Quadratic contact triple point	11
I. Dirac point	11
J. Charge-2 Dirac point	11
K. Charge-4 Dirac point	12
L. Quadratic Dirac point	13
M. Charge-4 quadratic Dirac point	13
N. Quadratic contact Dirac point	13
O. Cubic Dirac point	14
P. Sextuple point	14
Q. Charge-4 sextuple point	14
R. Quadratic contact sextuple point	15
S. Octuple point	15
T. Weyl nodal line	16
U. Weyl nodal-line net	16
V. Quadratic nodal line	16
W. Cubic nodal line	17
X. Dirac nodal line	17
Y. Dirac nodal-line net	17
Z. Nodal surface	17
S4. Derivation of the coreps of type-II MSGs	18
A. Abstract group	18
B. Magnetic space groups and corepresentations	19
C. Concrete steps of the derivation of corep	21
D. Examples of deriving coreps	21
1. Single-valued coreps of type II MSG 76	21

\* Z. M. Yu and Z. Zhang contributed equally to this work.

† ygyao@bit.edu.cn

2. Double-valued coreps of type II MSG	92	24
S5. Spatial operators of 230 SGs		28
S6. Notations and defined matrices used in Sec. S7 and Sec. S8		38
A. Notations		38
B. Defined matrixes		39
1. Two-dimensional matrixes		39
2. Three-dimensional matrixes		40
3. Four-dimensional matrixes		41
4. Six-dimensional matrixes		42
5. Eight-dimensional matrixes		42
S7. Encyclopedia of emergent particles in 3D crystals without SOC effect		43
A. The single-valued corepresentations of the 230 type-II MSGs and the essential degeneracies		43
1. Notes to Sec. S7 A		43
2. SG 1-10		43
3. SG 11-20		50
4. SG 21-30		61
5. SG 31-40		74
6. SG 41-50		85
7. SG 51-60		100
8. SG 61-70		119
9. SG 71-80		137
10. SG 81-90		150
11. SG 91-100		161
12. SG 101-110		172
13. SG 111-120		184
14. SG 121-130		196
15. SG 131-140		214
16. SG 141-150		234
17. SG 151-160		245
18. SG 161-170		255
19. SG 171-180		265
20. SG 181-190		278
21. SG 190-200		292
22. SG 201-210		306
23. SG 211-220		316
24. SG 221-230		326
B. The accidental degeneracies on high-symmetry line		342
1. Notes to Sec. S7 B		342
2. SG 1-10		342
3. SG 11-20		344
4. SG 21-30		347
5. SG 31-40		354
6. SG 41-50		361
7. SG 51-60		371
8. SG 61-70		381
9. SG 71-80		394
10. SG 81-90		401
11. SG 91-100		406
12. SG 101-110		412
13. SG 111-120		422
14. SG 121-130		427
15. SG 131-140		437
16. SG 141-150		451
17. SG 151-160		455
18. SG 161-170		459



19. SG 171-180	464
20. SG 181-190	472
21. SG 191-200	481
22. SG 201-210	488
23. SG 211-220	493
24. SG 221-230	498
C. Effective Hamiltonian of both essential and accidental degeneracies	508
1. Notes to Sec. S7 C	508
2. SG 1-10	508
3. SG 11-20	511
4. SG 21-30	517
5. SG 31-40	527
6. SG 41-50	537
7. SG 51-60	551
8. SG 61-70	571
9. SG 71-80	588
10. SG 81-90	599
11. SG 91-100	607
12. SG 101-110	616
13. SG 111-120	631
14. SG 121-130	639
15. SG 131-140	656
16. SG 141-150	677
17. SG 151-160	685
18. SG 161-170	690
19. SG 171-180	698
20. SG 181-190	707
21. SG 191-200	720
22. SG 201-210	732
23. SG 211-220	740
24. SG 221-230	749
S8. Encyclopedia of emergent particles in 3D crystals with SOC effect	769
A. The double-valued corepresentations of the 230 type-II MSGs and the essential degeneracies	769
1. Notes to Sec. S8 A	769
2. SG 1-10	769
3. SG 11-20	775
4. SG 21-30	783
5. SG 31-40	793
6. SG 41-50	803
7. SG 51-60	813
8. SG 61-70	823
9. SG 71-80	833
10. SG 81-90	843
11. SG 91-100	853
12. SG 101-110	863
13. SG 111-120	873
14. SG 121-130	883
15. SG 131-140	893
16. SG 141-150	903
17. SG 151-160	913
18. SG 161-170	923
19. SG 171-180	933
20. SG 181-190	943
21. SG 191-200	953
22. SG 201-210	961
23. SG 211-220	971
24. SG 221-230	981

B. The accidental degeneracies on high-symmetry line	991
1. Notes to Sec. S8 B	991
2. SG 1-10	991
3. SG 11-20	993
4. SG 21-30	995
5. SG 31-40	999
6. SG 41-50	1003
7. SG 51-60	1006
8. SG 61-70	1009
9. SG 71-80	1012
10. SG 81-90	1016
11. SG 91-100	1019
12. SG 101-110	1025
13. SG 111-120	1029
14. SG 121-130	1032
15. SG 131-140	1035
16. SG 141-150	1037
17. SG 151-160	1040
18. SG 161-170	1044
19. SG 171-180	1047
20. SG 181-190	1054
21. SG 191-200	1059
22. SG 201-210	1062
23. SG 211-220	1066
24. SG 221-230	1070
C. Effective Hamiltonian of both essential and accidental degeneracies	1072
1. Notes to Sec. S8 C	1072
2. SG 1-10	1072
3. SG 11-20	1076
4. SG 21-30	1082
5. SG 31-40	1091
6. SG 41-50	1100
7. SG 51-60	1106
8. SG 61-70	1112
9. SG 71-80	1116
10. SG 81-90	1123
11. SG 91-100	1128
12. SG 101-110	1138
13. SG 111-120	1147
14. SG 121-130	1154
15. SG 131-140	1159
16. SG 141-150	1163
17. SG 151-160	1168
18. SG 161-170	1176
19. SG 171-180	1182
20. SG 181-190	1191
21. SG 191-200	1201
22. SG 201-210	1206
23. SG 211-220	1213
24. SG 221-230	1221
References	1226

# S1. DERIVATION OF LATTICE MODEL WITH SG 211

In the main text, we establish a six-band lattice model for SG 211. In this model, each unit cell contains six  $s$ -like orbital states locating at  $12d$  Wyckoff positions. The lattice Hamiltonian is established by imposing symmetry constraints [1] and can be expressed as

$$H = c_0 + \begin{bmatrix} f(0, k_y, k_z) & h_{12} & h_{13} \\ h_{12}^\dagger & f(k_x, 0, k_z) & h_{23} \\ h_{13}^\dagger & h_{23}^\dagger & f(k_x, k_y, 0) \end{bmatrix},$$

with  $f(\mathbf{k}) = c_1 \cos \frac{k_x}{2} \cos \frac{k_y}{2} \cos \frac{k_z}{2} \sigma_1$  and

$$\begin{aligned} h_{12} &= c_2 \begin{bmatrix} e^{i \frac{k_x + k_y}{4}} & e^{i \frac{k_x - k_y}{4}} \\ e^{i \frac{-k_x + k_y}{4}} & e^{i \frac{-k_x - k_y}{4}} \end{bmatrix} + c_3 \begin{bmatrix} e^{-i \frac{k_x + k_y + 2k_z}{4}} & e^{i \frac{-k_x + k_y + 2k_z}{4}} \\ e^{i \frac{k_x - k_y + 2k_z}{4}} & e^{i \frac{k_x + k_y - 2k_z}{4}} \end{bmatrix}, \\ h_{13} &= c_2 \begin{bmatrix} e^{-i \frac{k_x + k_z}{4}} & e^{i \frac{-k_x + k_z}{4}} \\ e^{i \frac{k_x - k_z}{4}} & e^{i \frac{k_x + k_z}{4}} \end{bmatrix} + c_3 \begin{bmatrix} e^{i \frac{k_x + 2k_y + k_z}{4}} & e^{i \frac{k_x - 2k_y - k_z}{4}} \\ e^{i \frac{-k_x - 2k_y + k_z}{4}} & e^{i \frac{-k_x + 2k_y - k_z}{4}} \end{bmatrix}, \\ h_{23} &= c_2 \begin{bmatrix} e^{i \frac{k_y + k_z}{4}} & e^{i \frac{k_y - k_z}{4}} \\ e^{i \frac{-k_y + k_z}{4}} & e^{i \frac{-k_y - k_z}{4}} \end{bmatrix} + c_3 \begin{bmatrix} e^{i \frac{-2k_x - k_y - k_z}{4}} & e^{i \frac{2k_x - k_y + k_z}{4}} \\ e^{i \frac{2k_x + k_y - k_z}{4}} & e^{i \frac{-2k_x + k_y + k_z}{4}} \end{bmatrix}. \end{aligned}$$

The coefficients  $c_i$  with  $i = 0, 1, 2, 3$  is real model parameter. For the results shown in the main text, we have taken the following parameter values:  $c_0 = 2.8$ ,  $c_1 = -1.8$ ,  $c_2 = 1$ . and  $c_3 = -0.5$ .

## S2. QUANTITATIVE MAPPING BETWEEN EMERGENT PARTICLES AND TYPE-II MSGS

For each emergent particle listed in main text, we explicitly present the number of the type-II magnetic space group (MSG) that can host it. Table S1 is for the 3D crystals without SOC and Table S2 is for the crystals with SOC.

TABLE S1. List of the type-II MSGs hosting the symmetry-protected degeneracies in the crystals without SOC.

Species	SG No.
The essential degeneracies at high-symmetry point and high-symmetry line	
C-1 WP	24, 80, 98, 150, 152, 154, 168-173, 177-182, 199, 210, 214
C-2 WP	75-80, 89-98, 143-146, 149-155, 168-173, 177-182, 196, 207-210
C-4 WP	195-199, 207-214
TP	204, 217, 229
C-2 TP	195-199, 207-214
QCTP	200-206, 215-230
DP	29, 33, 52, 54, 56, 60, 73, 103, 104, 106, 110, 130, 138, 142, 158, 159, 161, 163, 165, 167, 184, 185, 192, 193, 206, 219, 220, 226, 228, 230
C-2 DP	19, 92, 96, 198, 212, 213
QDP	114, 124, 126, 128, 130, 133, 135, 137, 176, 184-186, 188, 190, 192-194, 222
QCDP	218, 220, 222, 223, 230
SP	218, 220, 222, 223, 230
WNL	7, 9, 13-15, 27-34, 37, 39-41, 43, 45, 46, 48-50, 52-54, 56, 58, 60, 64, 66-68, 70, 72-74, 85-88, 100-106, 108-110, 112, 114, 116-118, 120, 122, 124-126, 128, 130-138, 140-142, 147, 148, 156-167, 175, 176, 183-186, 188-194, 200-206, 215-230
WNL net	7, 9, 13-15, 27-34, 37, 39-41, 43, 45, 46, 48-50, 52-54, 56, 58, 60, 64, 66-68, 70, 72-74, 84-86, 88, 100-110, 112, 114, 116-118, 120-122, 124-126, 128, 130-142, 147, 148, 156-167, 184, 188, 190, 192, 215-230
QNL	81-88, 99-142, 174-176, 183-194, 215-230
DNL	57, 60-62, 205
DNL net	61
(one) NS	4, 11, 14, 17, 20, 26, 29, 31, 33, 36, 51-54, 63, 64, 76, 78, 91, 95, 169, 170, 173, 176, 178, 179, 182, 185, 186, 193, 194
(two) NSs	18, 55-60, 90, 94, 113, 114, 127-130, 135-138
(three) NSs	19, 61, 62, 92, 96, 198, 205, 212, 213
The accidental degeneracies on high-symmetry line	
C-1 WP	3-5, 16-24, 35-37, 44-46, 75-82, 89-98, 111-122, 139, 143-146, 149-156, 158, 168-174, 177-182, 187-188, 195-199, 207-216, 218, 219
C-2 WP	75-80, 89-98, 168-173, 177-182, 207-214
C-3 WP	168-173, 177-182
TP	81-88, 99-142, 147, 148, 156-167, 174-176, 183-194, 200-206, 215-230
QTP	175, 176, 183-186, 191-194
DP	26, 29, 31, 33, 36, 51-64, 113, 114, 127-130, 135-138, 175, 176, 183-186, 191-194, 205
C-2 DP	18, 19, 90, 92, 94, 96, 198, 212, 213
QDP	113, 114, 127-130, 135-138
WNL	10-15, 25-74, 83-88, 99-142, 156-159, 162-167, 174-176, 183-194, 200-206, 215-230
WNL (net)	25-74, 83-88, 99-142, 156-167, 175-176, 183-194, 200-206, 215-230

TABLE S2. List of the type-II MSGs hosting the symmetry-protected degeneracies in the crystals with SOC.

Species	SG No.
The essential degeneracies at high-symmetry point and high-symmetry line	
C-1 WP	1, 3-5, 8-9, 16-24, 35-37, 42-46, 75-82, 89-98, 111, 112, 119-122, 143-146, 149-155, 168-173, 177-182, 195-199, 207-214
C-2 WP	80, 98, 210
C-3 WP	143-146, 149-155, 168-173, 177-182, 196, 209, 210
TP	220
C-2 TP	199, 214
DP	11, 13-15, 26-27, 29-34, 36-37, 43, 48-50, 52-54, 56, 58, 60, 64, 66-68, 70, 72-74, 84-86, 88, 100-106, 108-110, 112, 114, 116-118, 122, 124-126, 128, 130-138, 140-142, 158, 159, 161, 163, 165, 167, 184-186, 188, 190, 192, 198, 201, 203-204, 206, 215-220, 222-224, 226-230
C-2 DP	18, 19, 90, 92, 94, 96, 212, 213
C-4 DP	195-199, 207-214
QDP	142, 228
C-4 QDP	92, 96
QC DP	200-206, 221-230
CDP	163, 165, 167, 184-186, 192, 226, 228
SP	206, 230
C-4 SP	198, 212, 213
QC SP	205
OP	130, 135, 218, 220, 222, 223, 230
WNL	6-9, 25-46, 81-82, 99-122, 156-161, 174, 183-190, 215-220
WNL net	45, 109, 110, 120, 122, 156-161, 174, 184, 187-190, 215-220
QNL	174, 187-190
CNL	183-186
DNL	51-64, 113-114, 127-130, 135-138, 176, 193-194, 205
DNL net	52, 54-56, 58, 60, 62, 127-128, 130, 135-136, 138, 176, 193-194
(one) NS	4, 17, 20, 26, 29, 31, 33, 36, 76, 78, 91, 95, 169, 170, 173, 178, 179, 182, 185, 186
(two) NSs	18, 90, 94, 113, 114
(three) NSs	19, 92, 96, 198, 212, 213
The accidental degeneracies on high-symmetry line	
C-1 WP	3-5, 16-24, 35-37, 44-46, 75-82, 89-98, 111-122, 143-146, 149-156, 158, 168-174, 177-182, 187-188, 195-199, 207-216, 218, 219
C-2 WP	75-80, 89-98, 168-173, 177-182, 207-214
C-3 WP	168-173, 177-182
TP	156-161, 174, 183-190, 215-220
DP	13-15, 26, 29, 31, 33, 36, 48-50, 52-54, 56, 58-60, 64, 66-68, 70, 72-74, 83-88, 99-110, 123-142, 147-148, 162-167, 175, 176, 183-186, 191-194, 200-206, 221-230
C-2 DP	18-19, 90, 92, 94, 96, 198, 212, 213
QDP	175-176, 191-194
WNL	25-46, 99-122, 156-159, 174, 183-190, 215-220
WNL net	28-34, 40-41, 43, 100, 102, 104, 106, 109-110, 117, 118, 122, 156-161, 183-190, 215-220
DNL	51-64, 128-130, 136-138, 176, 193-194, 205
DNL net	57, 60-62, 205



### S3. EMERGENT PARTICLES IN 3D CRYSTALS

As discussed in main text, we have performed an exhaustive investigation over all the symmetry-protected band degeneracies in 3D crystals with  $\mathcal{T}$  symmetry, as shown in Sec. S7. Thus it becomes possible to introduce a uniform notation to label the degeneracies and then the emergent particles. In this work, we classify the band degeneracy from four perspectives: the dimension of degeneracy manifold, the degree of degeneracy, the type of dispersion, and the topological charge. For dimension of degeneracy manifold, we term the 0D, 1D and 2D band degeneracy as point, line and surface, respectively, and for degree of degeneracy, we term the two-, three-, four-, six- and eight-fold degeneracy as Weyl, triple, Dirac, sextuple, and octuple point/line/surface, respectively. Moreover, we find that the leading order band energy splitting of emergent particles along certain direction can be linear, quadratic and cubic. At last, a  $d$ -D degeneracy in 3D systems can be topologically characterized by a topological charge defined on a  $(3-d-1)$ -D sphere enclosing the degeneracy [2]. Specifically, the nodal point is characterized by Chern number, which is a  $\mathbb{Z}$ -valued topological charge, the nodal line is characterized by Berry phase, which is a  $\mathbb{Z}_2$ -valued topological charge, and the nodal line also is characterized a  $\mathbb{Z}_2$ -valued topological charge [3, 4].

A complete list of the emergent particles according to this classification has been presented in Table I in main text. In the following, we discuss the possible Hamiltonian and the typical band structure of the emergent particles one by one.

#### A. Charge-1 Weyl point

The charge-1 Weyl point (C-1 WP) is a 0D two-fold band degeneracy. It features a linear energy splitting along any direction in momentum space, and can occur at a generic  $\mathbf{k}$  point in BZ. Moreover, the topological charge (Chern number) of C-1 WP is  $\mathcal{C} = \pm 1$ . A typical band structure of C-1 WP is schematically shown in Fig. S1(a).

A general Hamiltonian of C-1 WP is

$$H_{\text{C-1 WP}} = \sum_{i=0}^3 (c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z) \sigma_i. \quad (\text{S1})$$

With additional symmetry, the Hamiltonian (S1) would be simplified. A possible simple Hamiltonian for C-1 WP may be written as

$$H_{\text{C-1 WP}} = c_1 k_z + c_2 k_z \sigma_3 + (\alpha k_- \sigma_+ + h.c.), \quad (\text{S2})$$

with  $k_{\pm} = k_x \pm ik_y$  and  $\sigma_{\pm} = (\sigma_x \pm i\sigma_y)/2$ . The C-1 WP can be further classified as type I and type II [5]. For example, the C-1 WP described by Eq. (S2) is type I when  $|c_2| > |c_1|$  and is type II when  $|c_2| < |c_1|$ . However, when C-1 WP locates at  $\mathcal{T}$ -symmetric point, it can not be type II, as  $\mathcal{T}$ -symmetry requires  $c_1 = 0$ .

#### B. Charge-2 Weyl point

The charge-2 Weyl point (C-2 WP) is a 0D two-fold band degeneracy with a topological charge  $\mathcal{C} = \pm 2$ . It features a linear dispersion along one direction and a quadratic energy splitting in the plane normal to the direction. The C-2 WP can occur on high-symmetry line or at high-symmetry point in BZ. A typical band structure of C-2 WP is schematically shown in Fig. S1(b).

A possible Hamiltonian for C-2 WP may be written as

$$H_{\text{C-2 WP}} = c_1 k_z + c_2 k_{\parallel}^2 + c_3 k_z \sigma_3 + (\alpha k_+^2 \sigma_+ + h.c.), \quad (\text{S3})$$

with  $k_{\parallel} = \sqrt{k_x^2 + k_y^2}$ . The C-2 WP can be further classified as type I, type II and type III [6]. For example, the C-2 WP described by Eq. (S3) is type I when  $|c_3| > |c_1|$  and  $|\alpha| > |c_2|$ , is type II when  $|c_3| < |c_1|$ , and is type III when  $|c_3| > |c_1|$  and  $|\alpha| < |c_2|$ . Similarly, the C-2 WP at a  $\mathcal{T}$ -symmetric point cannot be type II.

#### C. Charge-3 Weyl point

The charge-3 Weyl point (C-3 WP) is a 0D two-fold band degeneracy with a topological charge  $\mathcal{C} = \pm 3$ . It features a linear dispersion along one direction and a cubic energy splitting in the plane normal to the direction. The C-3

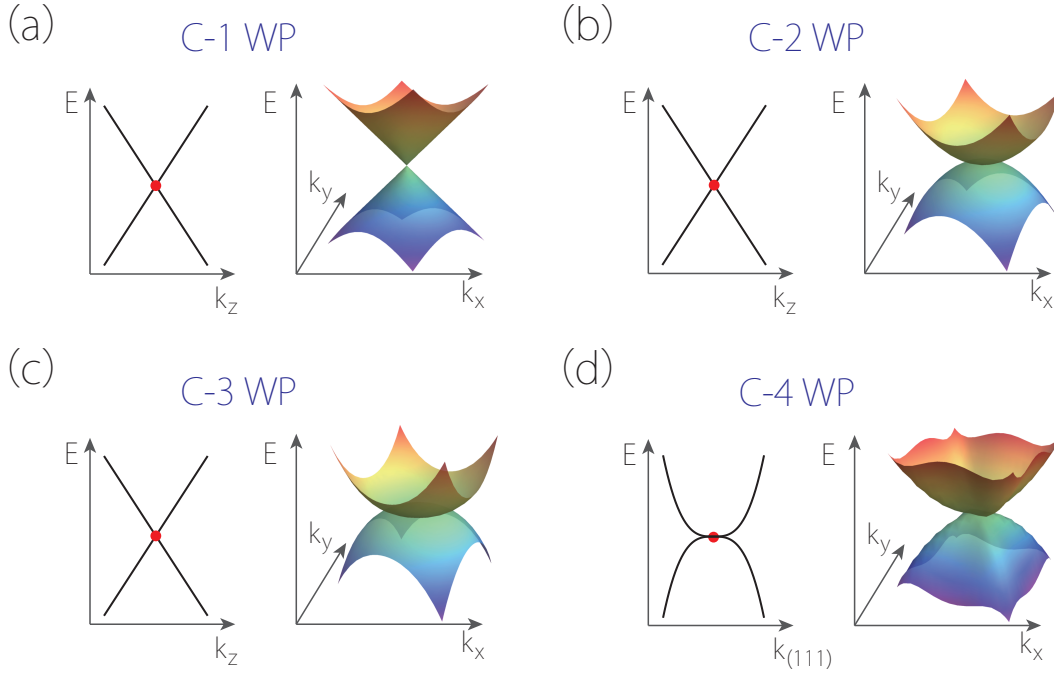


FIG. S1. Typical band structure of possible Weyl points in 3D crystals.

WP can occur on high-symmetry line or at high-symmetry point in BZ. A typical band structure of C-3 WP is schematically shown in Fig. S1(c).

A possible Hamiltonian for C-3 WP may be written as

$$H_{\text{C-3 WP}} = c_1 k_z + c_2 k_{\parallel}^2 + c_3 k_z \sigma_3 + (\alpha k_+^3 \sigma_+ + h.c.). \quad (\text{S4})$$

The C-3 WP can be further classified as type I, type II and type III, depending on model parameters.

#### D. Charge-4 Weyl point

The charge-4 Weyl point (C-4 WP) is a 0D two-fold band degeneracy with a topological charge  $\mathcal{C} = \pm 4$ . It features a cubic energy splitting along one direction and a quadratic energy splitting in the plane normal to the direction. The C-4 WP only occurs at certain  $\mathcal{T}$ -symmetric points in spinless systems. A typical band structure of C-4 WP is schematically shown in Fig. S1(d).

A possible Hamiltonian for C-4 WP may be written as

$$H_{\text{C-4 WP}} = c_1 k^2 + c_2 \left[ \sqrt{3}(k_x^2 - k_y^2) \sigma_1 + (k_x^2 + k_y^2 - 2k_z^2) \sigma_3 \right] + c_3 k_x k_y k_z \sigma_2, \quad (\text{S5})$$

with  $k = \sqrt{k_x^2 + k_y^2 + k_z^2}$ , which shows a cubic energy splitting along  $k_{(111)}$  direction and quadratic energy splitting along  $k_{x,y,z}$  direction.

#### E. Triple point

The triple point (TP) is a 0D three-fold band degeneracy, formed by a linear crossing between a doubly degenerate band and a non-degenerate band. The TP does not have a well-defined topological charge of Chern number, as there does not exist a fully gapped sphere surrounding TP in BZ. It features a linear energy splitting along any direction in momentum space, and can occur on high-symmetry line or at high-symmetry point in BZ. A typical band structure of TP is schematically shown in Fig. S2(a).

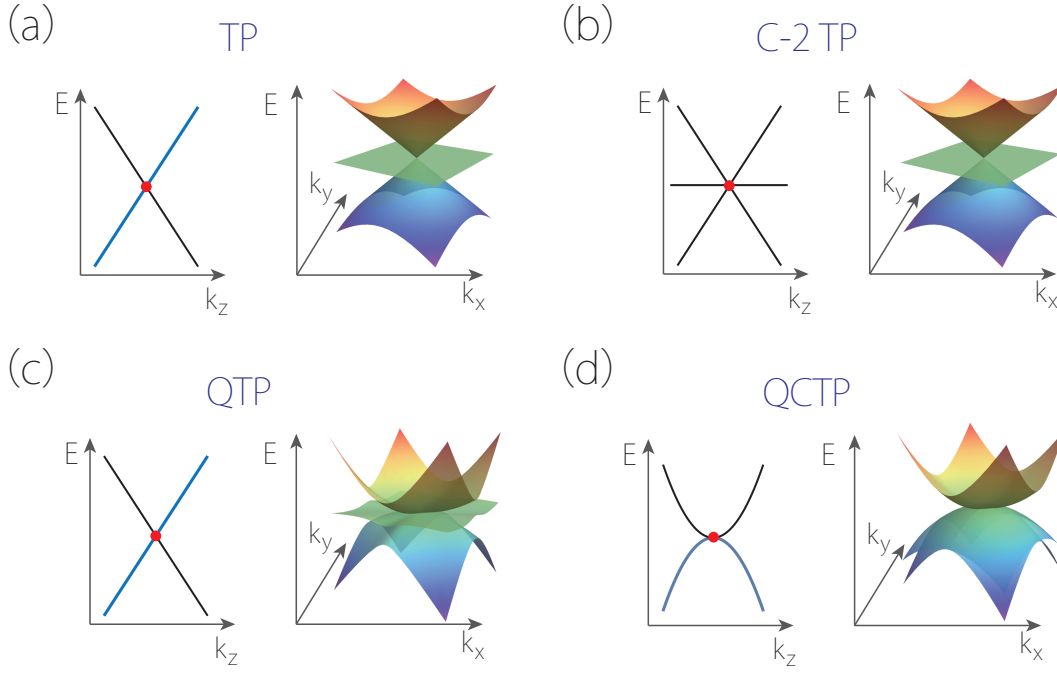


FIG. S2. Typical band structure of possible three-fold nodal points in 3D crystals. The black and blue curves denote non-degenerate and doubly degenerate bands, respectively.

A possible Hamiltonian for TP may be written as

$$H_{\text{TP}} = c_1 k_z + \begin{bmatrix} c_2 k_z & \alpha k_y & \alpha k_x \\ \alpha^* k_y & -c_2 k_z & 0 \\ \alpha^* k_x & 0 & -c_2 k_z \end{bmatrix}. \quad (\text{S6})$$

The TP can be further classified as type I and type II depending on model parameters. For example, the TP described by Eq. (S6) is type I when  $|c_2| > |c_1|$  and is type II when  $|c_2| < |c_1|$ .

### F. Charge-2 Triple point

The charge-2 triple point (C-2 TP) is a 0D three-fold band degeneracy with a topological charge  $\mathcal{C} = \pm 2$ . It features a linear energy splitting along any direction in momentum space. The C-2 TP only occurs at high-symmetry point in BZ. A typical band structure of C-2 TP is schematically shown in Fig. S2(b).

A possible Hamiltonian for C-2 TP may be written as

$$H_{\text{C-2 TP}} = \begin{bmatrix} 0 & ik_z & ik_y \\ -ik_z & 0 & ik_x \\ -ik_y & -ik_x & 0 \end{bmatrix}, \quad (\text{S7})$$

which actually describes the conventional spin-1 Weyl fermion.

### G. Quadratic triple point

The quadratic triple point (QTP) is a 0D three-fold band degeneracy, formed by a linear crossing between a doubly degenerate band and a non-degenerate band along certain high-symmetry line. The QTP also does not have a well-defined topological charge of Chern number. However, in contrast to TP, QTP features a quadratic energy splitting in the plane normal to the high-symmetry line. The QTP only occurs on high-symmetry line in spinless systems. A typical band structure of QTP is schematically shown in Fig. S2(c).

A possible Hamiltonian for QTP may be written as

$$H_{\text{QTP}} = c_1 k_z + c_2 k_{\parallel}^2 + \begin{bmatrix} c_3 k_z + c_4 k_{\parallel}^2 & 0 & 0 \\ 0 & -c_3 k_z - c_4 k_{\parallel}^2 & 0 \\ 0 & 0 & -c_3 k_z - c_4 k_{\parallel}^2 \end{bmatrix} + c_5 \begin{bmatrix} 0 & 2ik_x k_y & i(k_x^2 - k_y^2) \\ -2ik_x k_y & 0 & 0 \\ -i(k_x^2 - k_y^2) & 0 & 0 \end{bmatrix} + c_6 \begin{bmatrix} 0 & 0 & 0 \\ 0 & k_y^2 & -k_x k_y \\ 0 & -k_x k_y & k_x^2 \end{bmatrix}. \quad (\text{S8})$$

The QTP can be further classified as type I, type II and type III, depending on model parameters.

### H. Quadratic contact triple point

The quadratic contact triple point (QCTP) is a 0D three-fold band degeneracy with a topological charge  $\mathcal{C} = 0$ . It features a quadratic energy splitting along any direction in momentum space, and splits into a doubly degenerate band and a non-degenerate band along certain high-symmetry line(s), and three non-degenerate bands at generic momentum points. The QCTP only occurs at high-symmetry point in spinless systems. A typical band structure of QCTP is schematically shown in Fig. S2(d).

A possible Hamiltonian that captures the essential physics of QCTP may be written as

$$H_{\text{QCTP}} = \begin{bmatrix} c_1 k_x^2 + c_2 (k_y^2 + k_z^2) & c_3 k_x k_y & c_3 k_x k_z \\ c_3 k_x k_y & c_1 k_y^2 + c_2 (k_x^2 + k_z^2) & c_3 k_y k_z \\ c_3 k_x k_z & c_3 k_y k_z & c_1 k_z^2 + c_2 (k_x^2 + k_y^2) \end{bmatrix}. \quad (\text{S9})$$

### I. Dirac point

The (charge-0) Dirac point (DP) is a 0D four-fold band degeneracy with a topological charge  $\mathcal{C} = 0$ . It features a linear dispersion along any direction in momentum space. The DP can occur on high-symmetry line or at high-symmetry point in BZ. The DP in a spinful system with spatial inversion symmetry  $I$  and  $\mathcal{T}$  splits into two doubly degenerate bands at each  $\mathbf{k}$  in BZ. For the other cases, the DP splits into four non-degenerate bands at a generic  $\mathbf{k}$ , but into two doubly degenerate bands along certain high-symmetry line(s). A typical band structure of DP is schematically shown in Fig. S3(a).

A possible Hamiltonian for DP may be written as

$$H_{\text{DP}} = c_1 k_z + \begin{bmatrix} c_2 k_z & -ic_3 k_+ & 0 & 0 \\ ic_3 k_- & -c_2 k_z & 0 & 0 \\ 0 & 0 & c_2 k_z & ic_3 k_- \\ 0 & 0 & -ic_3 k_+ & -c_2 k_z \end{bmatrix}. \quad (\text{S10})$$

The DP also can be further classified as type I and type II, depending on model parameters. However, the DP at  $\mathcal{T}$ -symmetric points cannot be type II.

### J. Charge-2 Dirac point

The charge-2 Dirac point (C-2 DP) is a 0D four-fold band degeneracy with a topological charge  $\mathcal{C} = \pm 2$ . It also features a linear dispersion along any direction in momentum space, and can occur on high-symmetry line or at high-symmetry point in BZ. Contrast to DP which can be considered as a combination of two C-1 WPs with opposite topological charge, the C-2 DP contains two C-1 WPs with same topological charge. The C-2 DP splits into four bands at a generic  $\mathbf{k}$  but into two doubly degenerate bands along certain high-symmetry line. A typical band structure of C-2 DP is schematically shown in Fig. S3(b).

A possible Hamiltonian for C-2 DP may be written as

$$H_{\text{C-2 DP}} = c_1 k_z + \begin{bmatrix} c_2 k_z & 0 & \alpha k_- & \beta k_+ \\ 0 & c_2 k_z & -\beta^* k_+ & \alpha^* k_- \\ \alpha^* k_+ & -\beta k_- & -c_2 k_z & 0 \\ \beta^* k_- & \alpha k_+ & 0 & -c_2 k_z \end{bmatrix}. \quad (\text{S11})$$

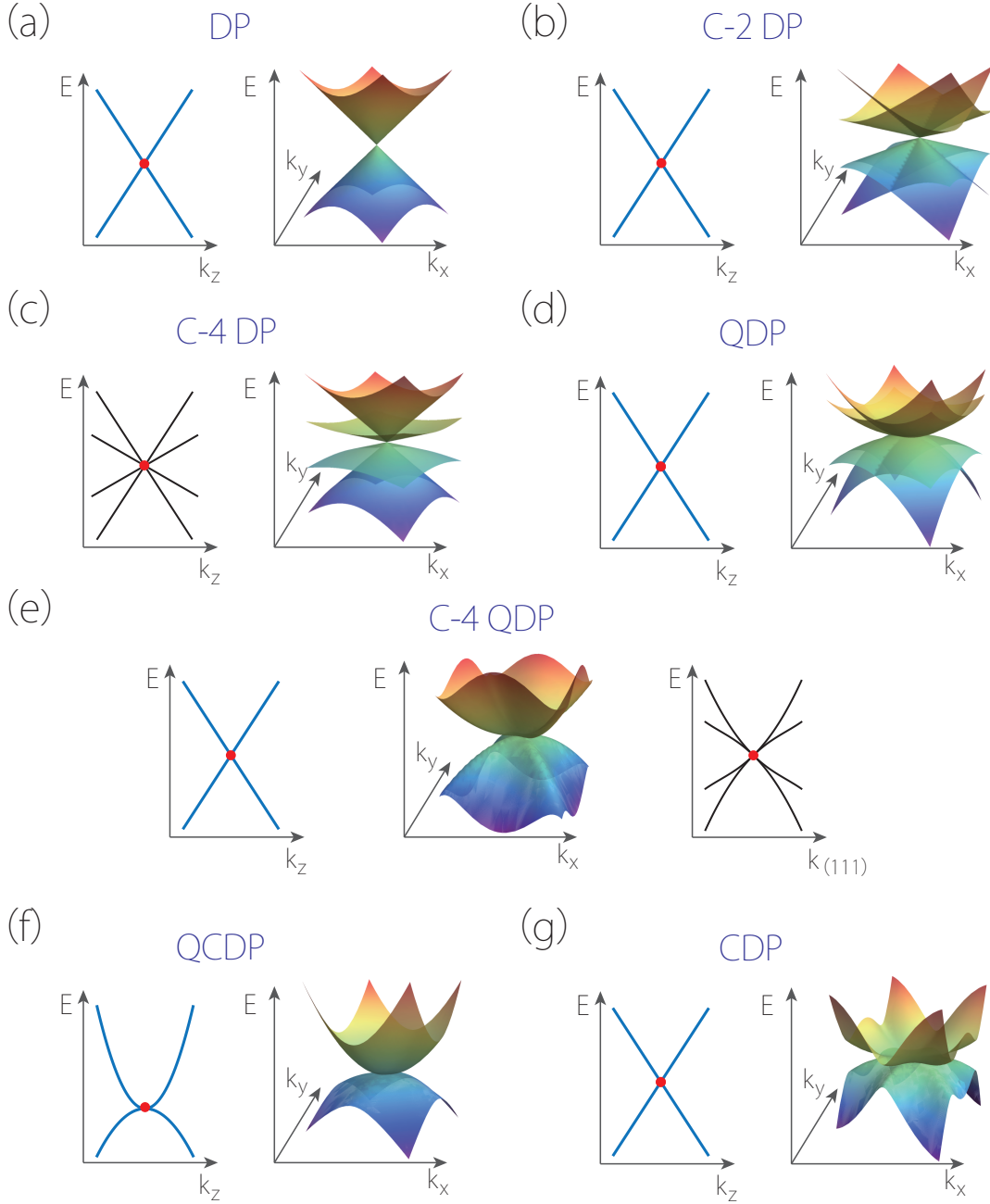


FIG. S3. Typical band structure of possible Dirac points in 3D crystals. The black and blue curves denote non-degenerate and doubly degenerate bands, respectively.

The C-2 DP can be further classified as type I and type II, depending on model parameters, while it at  $\mathcal{T}$ -symmetric point cannot be type II.

### K. Charge-4 Dirac point

The charge-4 Dirac point (C-4 DP) is a 0D four-fold band degeneracy with a topological charge  $\mathcal{C} = \pm 4$ . It features a linear dispersion along any direction in momentum space with all the four bands being fully splitted at each generic  $\mathbf{k}$ . The C-4 DP only occurs at high-symmetry point in spinful systems. A typical band structure of C-4 DP is schematically shown in Fig. S3(c).



A possible Hamiltonian for C-4 DP may be written as

$$H_{\text{C-4 DP}} = \begin{bmatrix} -c_1 k_z & c_1 k_+ & \alpha \frac{k_- + k_x - \sqrt{3}k_y}{2} & e^{-i2\pi/3} \alpha k_z \\ c_1 k_- & c_1 k_z & e^{-i2\pi/3} \alpha k_z & -\alpha \frac{k_+ + k_x + \sqrt{3}k_y}{2} \\ \alpha^* \frac{k_+ + k_x - \sqrt{3}k_y}{2} & e^{i2\pi/3} \alpha^* k_z & c_1 k_z & -c_1 k_- \\ e^{i2\pi/3} \alpha^* k_z & -\alpha^* \frac{k_- + k_x + \sqrt{3}k_y}{2} & -c_1 k_+ & -c_1 k_z \end{bmatrix}, \quad (\text{S12})$$

which essentially describes the conventional spin-3/2 Weyl fermion.

### L. Quadratic Dirac point

The (charge-0) quadratic Dirac point (QDP) is a 0D four-fold band degeneracy with a topological charge  $\mathcal{C} = 0$ . It is formed by a linear crossing between two doubly degenerate bands along certain high-symmetry line, and has a quadratic energy splitting in the plane normal to the high-symmetry line. The QDP in a spinful system with  $I$  and  $\mathcal{T}$  symmetries splits into two doubly degenerate bands at each  $\mathbf{k}$  in BZ. For the other cases, it splits into four non-degenerate bands at a generic  $\mathbf{k}$ . The QDP can occur on high-symmetry line or at high-symmetry point in BZ. A typical band structure of QDP is schematically shown in Fig. S3(d).

A possible Hamiltonian for QDP may be written as

$$H_{\text{QDP}} = c_1 k_z + c_2 k_{\parallel}^2 + \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{bmatrix} (c_3 k_z + c_4 k_{\parallel}^2) + \begin{bmatrix} c_5 & \alpha_1 & 0 & 0 \\ \alpha_1^* & -c_5 & 0 & 0 \\ 0 & 0 & c_6 & \alpha_2 \\ 0 & 0 & \alpha_2^* & -c_6 \end{bmatrix} k_x k_y + \begin{bmatrix} 0 & 0 & \alpha_3 & \alpha_4 \\ 0 & 0 & \alpha_4^* & -\alpha_3^* \\ \alpha_3^* & \alpha_4 & 0 & 0 \\ \alpha_4^* & -\alpha_3 & 0 & 0 \end{bmatrix} (k_x^2 - k_y^2), \quad (\text{S13})$$

The QDP can be further classified as type I, type II and type III depending on model parameters, while it at  $\mathcal{T}$ -symmetric point cannot be type II.

### M. Charge-4 quadratic Dirac point

The charge-4 quadratic Dirac point (C-4 QDP) is a 0D four-fold band degeneracy with a topological charge  $\mathcal{C} = \pm 4$ . It has a linear dispersion along certain high-symmetry line and a quadratic energy splitting in the plane normal to the line. The C-4 QDP can be considered as a combination of two C-2 WPs with same topological charge, and only occurs at certain high-symmetry points in spinful systems. The C-4 QDP splits into two doubly degenerate bands at three high-symmetry planes and along certain high-symmetry line. However, it would split into four non-degenerate bands at a generic  $\mathbf{k}$ . A typical band structure of C-4 QDP is schematically shown in Fig. S3(e).

A possible Hamiltonian for C-4 QDP may be written as

$$H_{\text{C-4 QDP}} = c_1 k_{\parallel}^2 + \begin{bmatrix} c_3 k_x k_y & i c_2 k_z & \beta k_x k_y & \alpha k_z \\ -i c_2 k_z & -c_3 k_x k_y & -\alpha k_z & -\beta k_x k_y \\ \beta^* k_x k_y & -\alpha^* k_z & -c_3 k_x k_y & -i c_2 k_z \\ \alpha^* k_z & -\beta^* k_x k_y & i c_2 k_z & c_3 k_x k_y \end{bmatrix} + c_4 (k_x^2 - k_y^2) \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}. \quad (\text{S14})$$

### N. Quadratic contact Dirac point

The quadratic contact Dirac point (QCDP) is a 0D four-fold band degeneracy with a topological charge  $\mathcal{C} = 0$ . It feature a quadratic energy splitting along any direction in momentum space. The QCDP in a spinful system with  $I$  and  $\mathcal{T}$  symmetries splits into two doubly degenerate bands at each  $\mathbf{k}$  in BZ. For the other cases, it splits into four bands at a generic  $\mathbf{k}$  but into two doubly degenerate bands along certain high-symmetry line. The QCDP only occurs at high-symmetry point in BZ. A typical band structure of QCDP is schematically shown in Fig. S3(f).

A possible Hamiltonian for QCDP may be written as

$$H_{\text{QCDP}} = c_1 k^2 + c_2 (3k_x^2 - k^2) \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{bmatrix} + c_3 (k_y^2 - k_z^2) \begin{bmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & -1 & 0 \\ 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \\ + c_4 k_x k_y \begin{bmatrix} 0 & 0 & 1 & i \\ 0 & 0 & i & 1 \\ 1 & -i & 0 & 0 \\ -i & 1 & 0 & 0 \end{bmatrix} + c_4 k_x k_z \begin{bmatrix} 0 & 0 & 1 & -i \\ 0 & 0 & -i & 1 \\ 1 & i & 0 & 0 \\ i & 1 & 0 & 0 \end{bmatrix} + \sqrt{2} c_4 k_y k_z \begin{bmatrix} 0 & 0 & i & 0 \\ 0 & 0 & 0 & -i \\ -i & 0 & 0 & 0 \\ 0 & i & 0 & 0 \end{bmatrix}. \quad (\text{S15})$$

### O. Cubic Dirac point

The (charge-0) cubic Dirac point (CDP) is a 0D four-fold band degeneracy with a topological charge  $\mathcal{C} = 0$ . It is formed by a linear crossing between two doubly degenerate bands along certain high-symmetry line, and has a cubic energy splitting in the plane normal to the high-symmetry line. The CDP only occurs at certain high-symmetry points in spinful systems. When the systems have  $I$  and  $\mathcal{T}$  symmetries, the CDP would split into two doubly degenerate bands at each  $\mathbf{k}$  in BZ. For the other cases, the CDP would split into four non-degenerate bands at a generic  $\mathbf{k}$ , but into two doubly degenerate bands along certain high-symmetry line. A typical band structure of CDP is schematically shown in Fig. S3(g).

A possible Hamiltonian for CDP may be written as

$$H_{\text{CDP}} = \begin{bmatrix} c_1 k_{\parallel}^2 & i(c_3 k_+^3 + c_4 k_-^3) & 0 & k_z c_2 \\ -i(c_3 k_-^3 + c_4 k_+^3) & c_1 k_{\parallel}^2 & k_z c_2 & 0 \\ 0 & c_2 k_z & c_1 k_{\parallel}^2 & i(c_4 k_+^3 + c_3 k_-^3) \\ c_2 k_z & 0 & -i(c_4 k_-^3 + c_3 k_+^3) & c_1 k_{\parallel}^2 \end{bmatrix}. \quad (\text{S16})$$

### P. Sextuple point

The (charge-0) sextuple point (SP) is a 0D six-fold band degeneracy with a topological charge  $\mathcal{C} = 0$ . It features a linear energy splitting along any direction in momentum space. The SP only occurs at high-symmetry point in BZ. A typical band structure of SP is schematically shown in Fig. S4(a).

A possible Hamiltonian for SP may be written as

$$H_{\text{SP}} = \begin{bmatrix} 0 & c_1 k_x & -c_1 k_y & 0 & \alpha k_x & \alpha k_y \\ c_1 k_x & 0 & -c_1 k_z & -\alpha k_x & 0 & -\alpha k_z \\ -c_1 k_y & -c_1 k_z & 0 & -\alpha k_y & \alpha k_z & 0 \\ 0 & \alpha^* k_x & \alpha^* k_y & 0 & -c_1 k_x & c_1 k_y \\ -\alpha^* k_x & 0 & -\alpha^* k_z & -c_1 k_x & 0 & c_1 k_z \\ -\alpha^* k_y & \alpha^* k_z & 0 & c_1 k_y & c_1 k_z & 0 \end{bmatrix}. \quad (\text{S17})$$

### Q. Charge-4 sextuple point

The charge-4 sextuple point (C-4 SP) is a 0D six-fold band degeneracy with a topological charge  $\mathcal{C} = \pm 4$ . It linearly splits into six bands at a generic  $\mathbf{k}$ , but into three doubly degenerate bands along certain high-symmetry line and in three high-symmetry planes. The C-4 SP can be considered as a combination of two C-2 TPs with same topological charge, and only occurs at certain high-symmetry points in spinful systems. A typical band structure of C-4 SP is schematically shown in Fig. S4(b).

A possible Hamiltonian for C-4 SP may be written as

$$H_{\text{C-4 SP}} = \begin{bmatrix} 0 & \alpha_1 k_x & \alpha_1^* k_y & 0 & \alpha_2 k_x & \alpha_2 k_y \\ \alpha_1^* k_x & 0 & \alpha_1 k_z & \alpha_2 k_x & 0 & \alpha_2 k_z \\ \alpha_1 k_y & \alpha_1^* k_z & 0 & \alpha_2 k_y & \alpha_2 k_z & 0 \\ 0 & \alpha_2^* k_x & \alpha_2^* k_y & 0 & -\alpha_1^* k_x & -\alpha_1 k_y \\ \alpha_2^* k_x & 0 & \alpha_2^* k_z & -\alpha_1 k_x & 0 & -\alpha_1^* k_z \\ \alpha_2^* k_y & \alpha_2^* k_z & 0 & -\alpha_1^* k_y & -\alpha_1 k_z & 0 \end{bmatrix}. \quad (\text{S18})$$

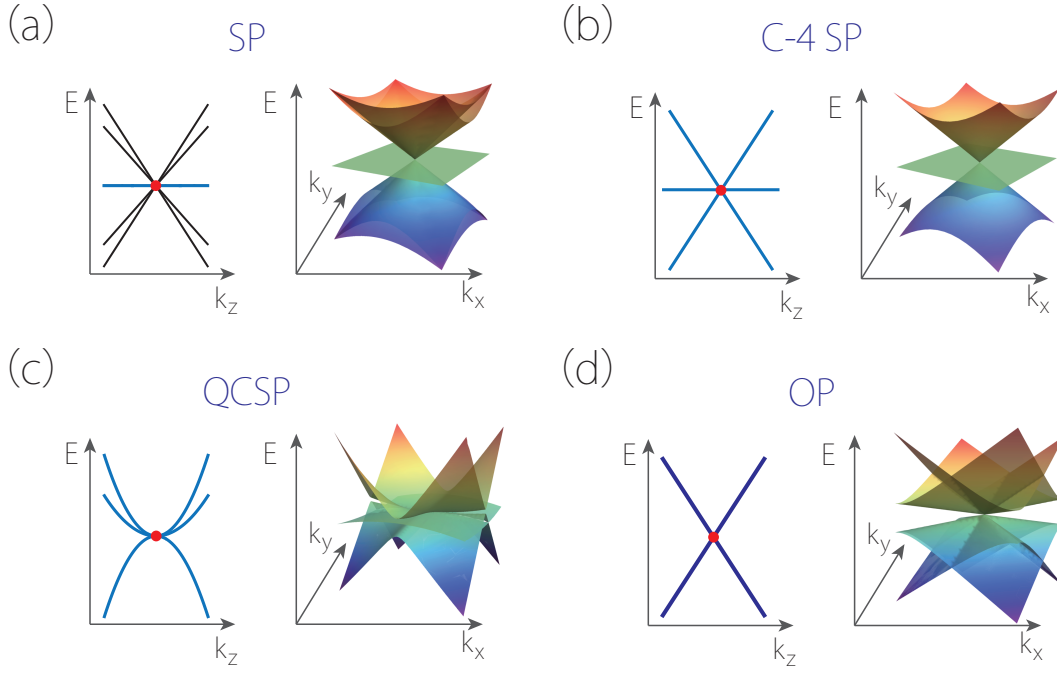


FIG. S4. Typical band structure of possible Dirac points in 3D crystals. The black, blue and dark blue curves denote non-degenerate, doubly degenerate and four-fold degenerate bands, respectively.

### R. Quadratic contact sextuple point

The quadratic contact sextuple point (QCSP) is a 0D six-fold band degeneracy with a topological charge  $\mathcal{C} = 0$ . It features a quadratic dispersion along any direction in momentum space. Interestingly, the QCSP only occurs in spinful systems with SG 205 locating at high-symmetry point  $R$ . The QCSP splits into three doubly degenerate bands at each  $\mathbf{k}$  in BZ as SG 205 has  $I$  symmetry. A typical band structure of QCSP is schematically shown in Fig. S4(c).

A possible Hamiltonian for QCSP may be written as

$$\begin{aligned}
 H_{\text{QCSP}} = & c_1 \begin{bmatrix} k_x^2 & 0 & 0 & 0 & 0 & 0 \\ 0 & k_z^2 & 0 & 0 & 0 & 0 \\ 0 & 0 & k_y^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & k_x^2 & 0 & 0 \\ 0 & 0 & 0 & 0 & k_z^2 & 0 \\ 0 & 0 & 0 & 0 & 0 & k_y^2 \end{bmatrix} + c_2 \begin{bmatrix} k_y^2 & 0 & 0 & 0 & 0 & 0 \\ 0 & k_x^2 & 0 & 0 & 0 & 0 \\ 0 & 0 & k_z^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & k_y^2 & 0 & 0 \\ 0 & 0 & 0 & 0 & k_x^2 & 0 \\ 0 & 0 & 0 & 0 & 0 & k_z^2 \end{bmatrix} + c_3 \begin{bmatrix} k_z^2 & 0 & 0 & 0 & 0 & 0 \\ 0 & k_y^2 & 0 & 0 & 0 & 0 \\ 0 & 0 & k_x^2 & 0 & 0 & 0 \\ 0 & 0 & 0 & k_z^2 & 0 & 0 \\ 0 & 0 & 0 & 0 & k_y^2 & 0 \\ 0 & 0 & 0 & 0 & 0 & k_x^2 \end{bmatrix} \\
 & + \begin{bmatrix} 0 & \alpha_1 k_y k_z & \alpha_1^* k_x k_z & 0 & \alpha_2 k_y k_z & -\alpha_2 k_x k_z \\ \alpha_1^* k_y k_z & 0 & \alpha_1 k_x k_y & -\alpha_2 k_y k_z & 0 & \alpha_2 k_x k_y \\ \alpha_1 k_x k_z & \alpha_1^* k_x k_y & 0 & \alpha_2 k_x k_z & -\alpha_2 k_x k_y & 0 \\ 0 & -\alpha_2^* k_y k_z & \alpha_2^* k_x k_z & 0 & \alpha_1^* k_y k_z & \alpha_1 k_x k_z \\ \alpha_2^* k_y k_z & 0 & -\alpha_2^* k_x k_y & \alpha_1 k_y k_z & 0 & \alpha_1^* k_x k_y \\ -\alpha_2^* k_x k_z & \alpha_2^* k_x k_y & 0 & \alpha_1^* k_x k_z & \alpha_1 k_x k_y & 0 \end{bmatrix}. \quad (\text{S19})
 \end{aligned}$$

### S. Octupole point

The (charge-0) octupole point (OP) is a 0D eight-fold band degeneracy with a topological charge  $\mathcal{C} = 0$ . It features a linear energy dispersion along any direction in momentum space, and is formed by a linear crossing between two fourfold degenerate bands along certain high-symmetry line. When the systems have  $I$  and  $\mathcal{T}$  symmetries, the OP splits into four doubly degenerate bands at a generic  $\mathbf{k}$  in BZ. For the other cases, it would split into eight non-degenerate bands at a generic  $\mathbf{k}$ . The OP only occurs at certain high-symmetry points in spinful systems. A typical band structure of SP is schematically shown in Fig. S4(d).

A possible Hamiltonian for OP may be written as

$$H_{\text{OP}} = \begin{bmatrix} h_{11} & h_{12} \\ h_{12}^\dagger & h_{22} \end{bmatrix}, \quad (\text{S20})$$

with

$$h_{11} = \begin{bmatrix} c_1 k_y & c_1 k_x + i c_2 k_z & -i c_3 k_y & i c_3 k_x \\ c_1 k_x - i c_2 k_z & -c_1 k_y & i c_3 k_x & i c_3 k_y \\ i c_3 k_y & -i c_3 k_x & -c_1 k_y & -c_1 k_x - i c_2 k_z \\ -i c_3 k_x & -i c_3 k_y & -c_1 k_x + i c_2 k_z & c_1 k_y \end{bmatrix}, \quad (\text{S21})$$

$$h_{12} = \begin{bmatrix} 0 & \alpha_1 k_z & -\alpha_2 k_y & \alpha_2 k_x \\ -\alpha_1 k_z & 0 & \alpha_2 k_x & \alpha_2 k_y \\ \alpha_2 k_y & -\alpha_2 k_x & 0 & -\alpha_1 k_z \\ -\alpha_2 k_x & -\alpha_2 k_y & \alpha_1 k_z & 0 \end{bmatrix}, \quad (\text{S22})$$

$$h_{22} = \begin{bmatrix} c_1 k_y & c_1 k_x - i c_2 k_z & i c_3 k_y & -i c_3 k_x \\ c_1 k_x + i c_2 k_z & -c_1 k_y & -i c_3 k_x & -i c_3 k_y \\ -i c_3 k_y & i c_3 k_x & -c_1 k_y & -c_1 k_x + i c_2 k_z \\ i c_3 k_x & i c_3 k_y & -c_1 k_x - i c_2 k_z & c_1 k_y \end{bmatrix}. \quad (\text{S23})$$

### T. Weyl nodal line

The Weyl nodal line (WNL) is a 1D two-fold band degeneracy. The WNL features a linear energy dispersion in the plane normal to the line. Moreover, the topological charge (Berry phase) for WNL is  $\mathcal{C} = \pi$ . The WNL generally appears along high-symmetry line or in high-symmetry plane in BZ. A typical band structure of WNL is schematically shown in Fig. S5(a).

A possible Hamiltonian expanded at a general point  $\mathbf{K}$  on WNL may be written as

$$H_{\text{WNL}} = c_1 q_x + c_2 q_y + c_3 q_x \sigma_1 + c_4 q_y \sigma_2, \quad (\text{S24})$$

with the wave vector  $\mathbf{q}$  measured from  $\mathbf{K}$ . Here, we assume the  $q_x$ - $q_y$  plane passes through  $\mathbf{K}$  point and is normal to the WNL. The WNL can be further classified as type I, type II [7] and hybrid type [8], depending on model parameters.

### U. Weyl nodal-line net

The Weyl nodal-line net (WNL net) contains multiple WNLs, which share (at least) one nodal point in momentum space, as schematically shown in Fig. S5(b). The joint nodal point of the WNLs must locates at high-symmetry line or high-symmetry point in BZ, and are termed as P-WNLs in Sec. S7 A and Sec. S8 A.

A possible Hamiltonian expanded around a P-WNLs may be written as

$$H_{\text{WNL net}} = \left[ c_1 k_z + c_2 k_{\parallel}^2 + c_3 k_x (k_x^2 - 3k_y^2) \right] \sigma_3 + \alpha k_y (3k_x^2 - k_y^2) \sigma_1, \quad (\text{S25})$$

which indicates that the point described by Eq. (S25) is not isolated but shall be an joint point of three WNLs lying in three vertical mirror planes dictated by equation  $3k_x^2 - k_y^2 = 0$ . The band structure obtained from Eq. (S25) is shown in Fig. S5(b), where we set  $c_2 = c_3 = 0$  for the convenience of a clear presentation.

### V. Quadratic nodal line

The quadratic nodal line (QNL) is a 1D two-fold band degeneracy with a topological charge  $\mathcal{C} = 0 \bmod 2\pi$ . The QNL features a quadratic energy splitting in the plane normal to the line. It only appears along high-symmetry line in BZ. A typical band structure of QNL is schematically shown in Fig. S5(c).

A possible Hamiltonian expanded at a general point  $\mathbf{K}$  on QNL may be written as

$$H_{\text{QNL}} = c_1 k_{\parallel}^2 + (\alpha k_{\perp}^2 \sigma_{+} + h.c.). \quad (\text{S26})$$

The QNL can be further classified as type I, type III and hybrid type depending on model parameters.

### W. Cubic nodal line

The cubic nodal line (CNL) is a 1D two-fold band degeneracy with a topological charge  $\mathcal{C} = \pi \bmod 2\pi$ . The CNL features a cubic energy splitting in the plane normal to the line. It only appears along high-symmetry line in BZ. A typical band structure of CNL is schematically shown in Fig. S5(d).

A possible Hamiltonian expanded at a general point  $\mathbf{K}$  on CNL may be written as

$$H_{\text{CNL}} = c_1 k_{\parallel}^2 + (\alpha k_{+}^3 \sigma_{+} + h.c.). \quad (\text{S27})$$

### X. Dirac nodal line

The Dirac nodal line (DNL) is a 1D four-fold band degeneracy with a topological charge  $\mathcal{C} = 0 \bmod 2\pi$ . It features a linear dispersion in the plane normal to the line. The DNL in spinful systems with  $I$  and  $\mathcal{T}$  symmetries splits into two doubly degenerate bands at a generic  $\mathbf{k}$  in BZ. For the other cases, it splits into four bands at a generic  $\mathbf{k}$ , but would split into two doubly degenerate bands along certain high-symmetry line(s). It can appear along high-symmetry line or in high-symmetry plane in BZ. A typical band structure of DNL is schematically shown in Fig. S5(e).

A possible Hamiltonian expanded at a general point  $\mathbf{K}$  on DNL may be written as

$$H_{\text{DNL}} = c_1 k_z + \begin{bmatrix} 0 & c_2 k_y + i c_3 k_x & 0 & \alpha_1 k_x + \alpha_2 k_y \\ c_2 k_y - i c_3 k_x & 0 & -\alpha_1 k_x + \alpha_2 k_y & 0 \\ 0 & -\alpha_1^* k_x + \alpha_2^* k_y & 0 & -c_2 k_y - i c_3 k_x \\ \alpha_1^* k_x + \alpha_2^* k_y & 0 & -c_2 k_y + i c_3 k_x & 0 \end{bmatrix}. \quad (\text{S28})$$

The DNL can be further classified as type I, type II and hybrid type depending on model parameters.

### Y. Dirac nodal-line net

The Dirac nodal-line net (DNL net) contains multiple DNLs, which share (at least) one nodal point in momentum space, as schematically shown in Fig. S5(f). The joint nodal point of the DNLs must locate at high-symmetry line or high-symmetry point in BZ, and are termed as P-DNLs in Sec. S7 A and Sec. S8 A.

A possible Hamiltonian expanded around a P-DNLs may be written as

$$H_{\text{DNL net}} = \begin{bmatrix} c_1 k_x^2 + c_2 k_y^2 + c_3 k_z & 0 & c_7 k_x k_y & c_8 k_x k_y \\ 0 & c_1 k_x^2 + c_2 k_y^2 + c_3 k_z & -c_8 k_x k_y & c_7 k_x k_y \\ c_7 k_x k_y & -c_8 k_x k_y & -c_4 k_x^2 - c_5 k_y^2 - c_6 k_z & 0 \\ c_8 k_x k_y & c_7 k_x k_y & 0 & -c_4 k_x^2 - c_5 k_y^2 - c_6 k_z \end{bmatrix}, \quad (\text{S29})$$

which indicates that the point described by Eq. (S29) is not isolated but shall be an joint point of two DNLs lying in  $k_x = 0$  and  $k_y = 0$  mirror planes. The band structure obtained from Eq. (S29) is shown in Fig. S5(f).

### Z. Nodal surface

The nodal surface (NS) is a 2D two-fold band degeneracy. The NS only appears at the boundary plane of BZ and has linear dispersion along the direction normal to the surface. Moreover, the 2D nodal surface in 3D systems can be topologically characterized by a  $\mathbb{Z}_2$ -valued topological charge, which is defined on (a 0D sphere) two points surrounding the surface in BZ [2, 3]. A typical band structure of NS is schematically shown in the left picture of Fig. S5(g).

A possible Hamiltonian expanded around a general point  $\mathbf{K}$  in NS may be written as

$$H_{\text{NS}} = c_1 q + c_2 q \sigma_1, \quad (\text{S30})$$

with the wave vector  $q$  measured from  $\mathbf{K}$ . Here, we assume the  $q$  axis passes through  $\mathbf{K}$  point and is normal to the surface.

There only exist three possibilities for the NS semimetals, namely, the systems exhibits one NS, two NSs or three NSs, as illustrated in Fig. S5(g).



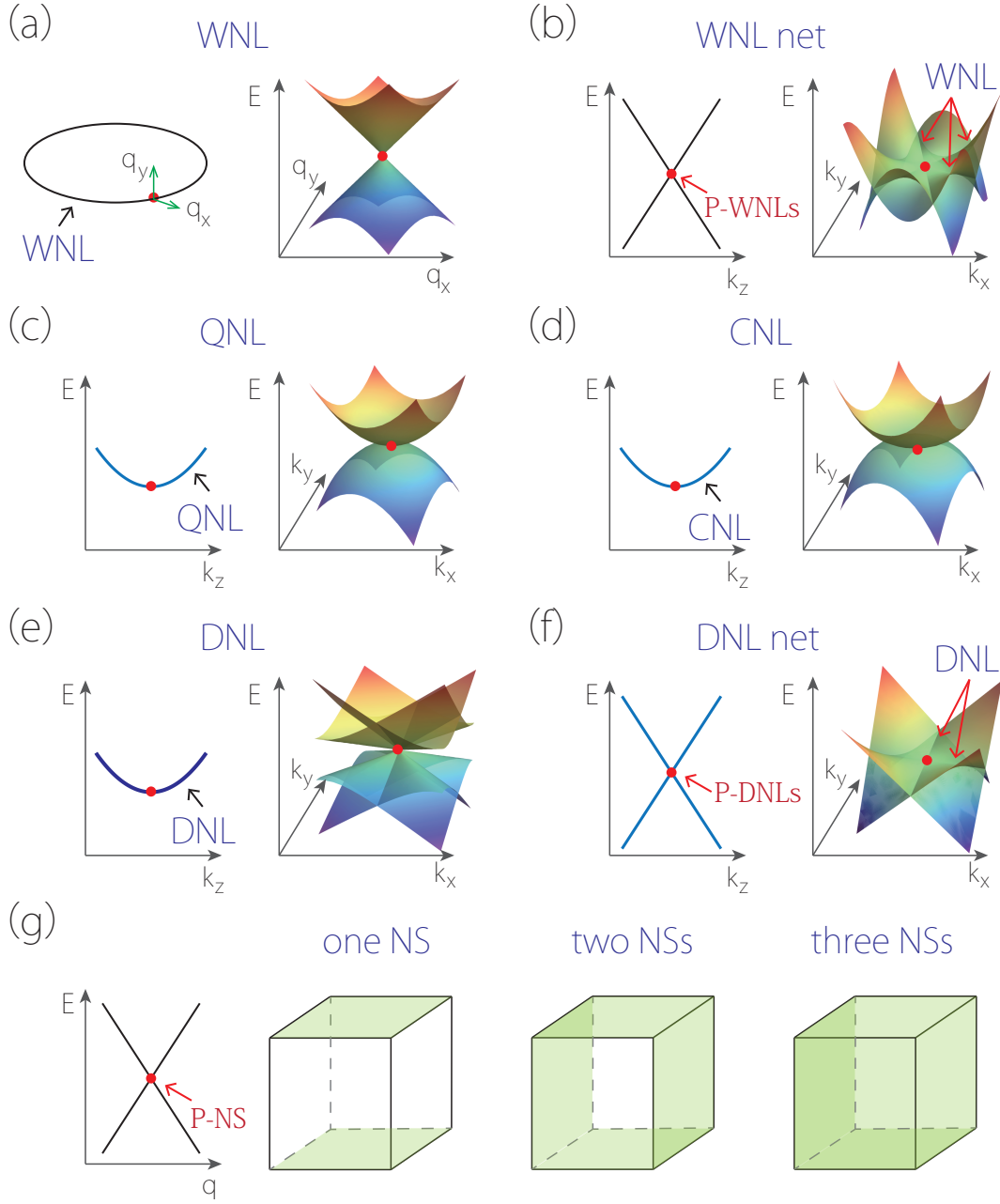


FIG. S5. Typical band structure of possible nodal line and nodal surface in 3D crystals. The black, blue and dark blue curves denote non-degenerate, doubly degenerate and four-fold degenerate bands, respectively.

#### S4. DERIVATION OF THE COREPS OF TYPE-II MSGS

##### A. Abstract group

It is known that for a generic momentum  $\mathbf{k}$  in BZ of a certain SG, its symmetry is described by a little group  $\mathbf{G}^{\mathbf{k}}$ . For high-symmetry point  $\mathbf{k}_1$ , the reps of  $\mathbf{G}^{\mathbf{k}_1}$  generally is related to those of Herring little group (see Sec. 3.8 in Ref. [9]) and for high-symmetry line  $\mathbf{k}_1$ , the reps of  $\mathbf{G}^{\mathbf{k}_1}$  is related to those of the central extension of the corresponding little co-group (see Sec. 3.7 in Ref. [9]). Notice that, different from the notation used in Ref. [9], we will abuse the symbol  $\mathbf{G}^{\mathbf{k}_1}$  to denote Herring little group (at high-symmetry points) and central extension (on high-symmetry lines) in the following discussion.  $\mathbf{G}^{\mathbf{k}_1}$  (the Herring little group or the central extension) for different high-symmetry

momenta in one SG or for same high-symmetry momentum in different SGs may be isomorphic to one certain abstract group, leading to a great simplification for investigating the reps of 230 SGs. In Ref. [9], the abstract group for each  $\mathbf{G}^{k_1}$  in 230 SGs are explicitly given in Table 5.7 and Table 6.13, respectively, and the rep information of the relevant abstract groups are presented in Table 5.1. Moreover, the correspondence between the reps of abstract group (labelled as  $R_i$  with  $i = 1, 2, 3, \dots$  in Ref. [9]) and the conventional notations of the reps of electronic bands can be found in Table 5.8 and Table 6.14 of Ref. [9], and a recent work by Liu et. al. [10].

## B. Magnetic space groups and corepresentations

The MSGs also is called as Shubnikov SGs, and can be subdivided into four types [9]. There exist in total 1651 MSGs. The type I MSGs are the ordinary 230 SGs, containing only unitary operators. A type I MSG,  $\mathbf{M}$ , is given by

$$\mathbf{M} = \mathbf{G}, \quad (\text{S31})$$

where  $\mathbf{G}$  is any ordinary SG. In the following, we use  $\mathbf{G}$  and  $\mathbf{M}$  to denote ordinary SG and MSG, respectively. The single- and double-valued reps of type I MSGs (e.g. the ordinary SGs) have been given in Ref. [9].

All the other three types of MSGs contain anti-unitary operators, e.g. the operators involve time-reversal symmetry  $\mathcal{T}$ . A type II MSG,  $\mathbf{M}$ , is given by

$$\mathbf{M} = \mathbf{G} + \mathcal{T}\mathbf{G}. \quad (\text{S32})$$

Clearly, there are 230 type II MSGs. Since  $\mathcal{T}$  commutes with all the SG operators, one then can rewrite the type II MSG  $\mathbf{M}$ , as  $\mathbf{M} = \mathbf{G} \otimes \{E + \mathcal{T}\}$  with  $E$  the identity operator. A type III MSG,  $\mathbf{M}$ , is given by

$$\mathbf{M} = \mathbf{H} + \mathcal{T}(\mathbf{G} - \mathbf{H}), \quad (\text{S33})$$

where  $\mathbf{H}$  is a halving subgroup of  $\mathbf{G}$ . The total number of type III MSG is 674, more than the number of the ordinary SG. At last, the type IV MSGs are defined on black and white Bravais lattices, which include two interpenetrating sublattices occupied by up-spin (black) and down-spin (white), respectively. A type IV MSG,  $\mathbf{M}$ , is given by

$$\mathbf{M} = \mathbf{G} + \mathcal{T}\{E|\mathbf{t}_0\}\mathbf{G}, \quad (\text{S34})$$

where  $\mathbf{t}_0$  is a translation connecting black and white Bravais lattices. There are 517 type IV MSGs. Generally, one can use a general form to rewrite the type II, III, and IV MSG, expressed as

$$\mathbf{M} = \mathbf{G}' + \mathcal{A}\mathbf{G}', \quad (\text{S35})$$

with  $\mathbf{G}'$  a unitary subgroup of  $\mathbf{M}$  and  $\mathcal{A}$  an anti-unitary element of  $\mathbf{M}$ . For type II MSG,  $\mathcal{A}$  is  $\mathcal{T}$  symmetry, and for type III MSG,  $\mathcal{A}$  is a combined operator containing  $\mathcal{T}$  and a spatial operator  $O$ . Notice that  $O$  is not an element of  $\mathbf{G}'$ . For type IV MSG, the anti-unitary operator  $\mathcal{A}$  is  $\mathcal{T}\{E|\mathbf{t}_0\}$ , namely,  $\mathcal{T}$  symmetry followed by a pure translation.

While one uses the representation theory to study the type I MSGs, e.g. the ordinary SGs, it is necessary to extend the representation theory to corepresentation theory [11] for studying type II, III, and IV MSGs, as they contain anti-unitary operators.

Without loss of generality, we consider a magnetic group

$$\mathbf{M}_0 = \mathbf{G}_0 + \mathcal{A}\mathbf{G}_0, \quad (\text{S36})$$

and assuming the rep information of  $\mathbf{G}_0$  is known. For a irreducible rep  $\Gamma$  of  $\mathbf{G}_0$  and an operator  $R \in \mathbf{G}_0$ , one has

$$R|\psi\rangle = \langle\psi|\Delta(R), \quad (\text{S37})$$

with  $|\psi\rangle$  the basis state of  $\Gamma$  and  $\Delta(R)$  the matrix representation of  $R$  in  $\Gamma$ . Then the basis state of  $\mathbf{M}_0$  can be written as  $|\psi, \phi\rangle$  with  $|\phi\rangle = \mathcal{A}|\psi\rangle$ . A straightforward calculation gives [9]

$$R|\psi, \phi\rangle = \langle\psi, \phi| \begin{bmatrix} \Delta(R) & \mathbf{0} \\ \mathbf{0} & \Delta^*(\mathcal{A}^{-1}R\mathcal{A}) \end{bmatrix}, \quad (\text{S38})$$

for  $R \in \mathbf{G}_0$ , and

$$B|\psi, \phi\rangle = \langle\psi, \phi| \begin{bmatrix} \mathbf{0} & \Delta(B\mathcal{A}) \\ \Delta^*(\mathcal{A}^{-1}B) & \mathbf{0} \end{bmatrix}, \quad (\text{S39})$$

for  $B \in \mathcal{AG}_0$ . The matrices

$$D(R) = \begin{bmatrix} \Delta(R) & \mathbf{0} \\ \mathbf{0} & \Delta^*(\mathcal{A}^{-1}RA) \end{bmatrix}, \quad D(B) = \begin{bmatrix} \mathbf{0} & \Delta(B\mathcal{A}) \\ \Delta^*(\mathcal{A}^{-1}B) & \mathbf{0} \end{bmatrix}, \quad (\text{S40})$$

are the coreps of  $\mathbf{M}_0$  derived from  $\Gamma$  of  $\mathbf{G}_0$ , which are denoted as  $D\Gamma$ . The relations of coreps are different from those of reps. The relations of reps are

$$\Delta(R)\Delta(S) = \Delta(RS), \quad (\text{S41})$$

with  $R, S \in \mathbf{G}_0$ . In contrast, the relations of coreps have a dependence on the first rep, given as

$$D(R)D(S) = D(RS), \quad D(B)D^*(S) = D(BS), \quad (\text{S42})$$

with  $R \in \mathbf{G}_0$ ,  $B \in \mathcal{AG}_0$  and  $S \in \mathbf{M}_0$ .

Notice that although  $\Gamma$  is a irreducible rep of  $\mathbf{G}_0$ , it does not mean the deduced corep  $D\Gamma$  also is irreducible. If there exist a unitary transformation changing  $D\Gamma$  to  $D'\Gamma$  and all the matrices of  $D'\Gamma$  are in the same block diagonal form, then the corep  $D\Gamma$  is reducible. In contrast, if there does not exist such transformation, the corep  $D\Gamma$  is irreducible. A irreducible (reducible) corep  $D\Gamma$  means that for an electronic band belonging to the rep  $\Gamma$ , its degeneracy is doubled (not affected) by the addition of  $\mathcal{A}$  symmetry to the group  $\mathbf{G}_0$ . There are three different cases for the deduced corep  $D\Gamma$  [9].

Case (a): The deduced corep  $D\Gamma$  is reducible, corresponding to the case that the addition of  $\mathcal{A}$  symmetry does not change the degeneracy of the electronic band with  $\Gamma$  rep. The matrix representation of the operators in  $\mathbf{M}_0$  for the corep  $D\Gamma$  then is

$$D(R) = \Delta(R), \quad D(B) = \Delta(B\mathcal{A}^{-1})N, \quad (\text{S43})$$

where  $N$  is determined by the following equations  $NN^* = \Delta(\mathcal{A}^2)$  and  $\Delta(R) = N\Delta^*(\mathcal{A}^{-1}RA)N^{-1}$ . From Eq. (S43), one directly knows

$$D(\mathcal{A}) = N. \quad (\text{S44})$$

Case (b): The deduced corep  $D\Gamma$  is irreducible, and  $\Delta(R)$  is equivalent to  $\Delta^*(\mathcal{A}^{-1}RA)$ . Then the matrix set for  $D\Gamma$  (S40) under unitary transformation can be written as

$$D(R) = \begin{bmatrix} \Delta(R) & \mathbf{0} \\ \mathbf{0} & \Delta(R) \end{bmatrix}, \quad D(B) = \begin{bmatrix} \mathbf{0} & -\Delta(B\mathcal{A}^{-1})N \\ \Delta(B\mathcal{A}^{-1})N & \mathbf{0} \end{bmatrix}, \quad (\text{S45})$$

where  $N$  is determined by the following equations  $NN^* = -\Delta(\mathcal{A}^2)$  and  $\Delta(R) = N\Delta^*(\mathcal{A}^{-1}RA)N^{-1}$ . The matrix representation of  $\mathcal{A}$  in this case can be written as

$$D(\mathcal{A}) = \begin{bmatrix} \mathbf{0} & -N \\ N & \mathbf{0} \end{bmatrix}. \quad (\text{S46})$$

Case (c): The deduced corep  $D\Gamma$  is irreducible, and  $\Delta(R)$  is not equivalent to  $\Delta^*(\mathcal{A}^{-1}RA)$ . The matrix set for  $D\Gamma$  then is

$$D(R) = \begin{bmatrix} \Delta(R) & \mathbf{0} \\ \mathbf{0} & \Delta^*(\mathcal{A}^{-1}RA) \end{bmatrix}, \quad D(B) = \begin{bmatrix} \mathbf{0} & \Delta(B\mathcal{A}) \\ \Delta^*(\mathcal{A}^{-1}B) & \mathbf{0} \end{bmatrix}, \quad (\text{S47})$$

and the matrix representation of  $\mathcal{A}$  in this case is

$$D(\mathcal{A}) = \begin{bmatrix} \mathbf{0} & \Delta(\mathcal{A}^2) \\ \mathbf{1} & \mathbf{0} \end{bmatrix}, \quad (\text{S48})$$

with  $\mathbf{1}$  denoting identity matrix. Hence, whenever the matrix  $N$  is solved, the coreps then are obtained. Notice that whether or not the degeneracy of the electronic bands is doubled by the addition of  $\mathcal{A}$ , the corresponding effective Hamiltonian of the bands would be inevitably affected, as  $\mathcal{A}$  imposes additional symmetry constraint on the effective Hamiltonian.

The single- and double-valued reps of 230 SGs has been fully investigated in previous works and can be conveniently accessed, such as from the classic book “The mathematical theory of symmetry in solids: Representation theory for point groups and space groups” [9] and the Bilbao Crystallographic Server [12]. However the notations of the reps used in Ref. [9] and Ref. [12] are different, and a correspondence between these two notations are given in a recent work by Liu et. al. [10]. In contrast, both single-valued and double-valued reps of type II, III and IV MSGs are still missing, which greatly hinders the continuous and rapid development of the field of topological semimetals.

### C. Concrete steps of the derivation of corep

In this work, we for the first time present complete tables for both single-valued and double-valued coreps of type II MSGs from the reps of type I MSGs (the ordinary SGs) presented in Ref. [9]. Thus, we adopt the notations of reps used in Ref. [9]. As stated in main text, to obtain the corep information of each type II MSG, we need to find its little groups  $\mathbf{M}^{k_1}$  at all high-symmetry momenta  $k_1$ , as well as the (co-)reps of  $\mathbf{M}^{k_1}$  and the corresponding matrix representation. While the type II MSG has one additional  $\mathcal{T}$  symmetry comparing with the corresponding SG, the high-symmetry momenta  $k_1$  in BZ of one certain type II MSG may or may not have additional symmetries comparing with that in corresponding SG. Nevertheless, the little groups  $\mathbf{M}^{k_1}$  must take the form of either

$$\mathbf{M}^{k_1} = \mathbf{G}^{k_1}, \quad (\text{S49})$$

or

$$\mathbf{M}^{k_1} = \mathbf{G}^{k_1} + \mathcal{A}\mathbf{G}^{k_1}, \quad (\text{S50})$$

with  $\mathbf{G}^{k_1}$  the corresponding crystallographic little group, for which the rep information is known and available, and  $\mathcal{A}$  a certain anti-unitary operator. Starting from here, the subsequent steps for obtaining the (co)rep information of  $\mathbf{M}^{k_1}$  are as follows.

First, for each  $\mathbf{M}^{k_1}$ , we find out all the symmetry operators to determine its suitable form [Eq. (S49) or Eq. (S50)].

Second, if  $\mathbf{M}^{k_1}$  has the form of Eq. (S49), its reps  $\Gamma_i$  and the corresponding matrix representations  $\Delta_{\Gamma_i}$  are available in Ref. [9].

Third, if  $\mathbf{M}^{k_1}$  has the form of Eq. (S50), we need to obtain the specific form of  $\mathcal{A}$  and derive the coreps  $D\Gamma$  of  $\mathbf{M}^{k_1}$  from those ( $\Gamma$ ) of  $\mathbf{G}^{k_1}$  (which is available in Ref. [9]) using the method discussed in Sec. S4B. A crucial point here is to determine which of the three cases, namely, Case (a)-(c) in Sec. S4B, is appropriate for a given rep  $\Gamma_i^{k_1}$  of a SG  $\mathbf{G}$ . Generally, this can be inferred from the reality of the induced SG reps ( $\Gamma_i^{k_1} \uparrow \mathbf{G}$ ) (see Sec. 4.6, 5.2 and 7.6 in Ref. [9]). Fortunately, this has already been done by Ref. [9], where Table 5.7 (Table 6.13) explicitly indicate the case type for all the single-valued (double-valued) reps  $\Gamma_i^{k_1}$  of each  $\mathbf{G}$  when adding  $\mathcal{T}$  symmetry to  $\mathbf{G}$ .

Finally, by tedious but straightforward calculations, we establish complete tables of single-valued and double-valued coreps of type II MSGs, along with the matrix representations of the generating elements, and the effective Hamiltonian of the symmetry-protected band degeneracies.

### D. Examples of deriving coreps

Here, we use two examples to show the details of deriving coreps of type II MSG from the reps of the corresponding SG, and discuss the underneath physics of extra degeneracy caused by the addition of  $\mathcal{T}$  symmetry. For single-valued or double-valued rep  $\Gamma_i^{k_1}$ , the relation between the reality of its induced SG reps  $\Gamma_i^{k_1} \uparrow \mathbf{G}$  and the three cases of extra degeneracies described in Sec. S4B is as follow [9]

single-valued reps		double-valued reps	
Reality	Degeneracy case	Reality	Degeneracy case
1	a	1	b
2	b	2	a
3	c	3	c

#### 1. Single-valued coreps of type II MSG 76

The single-valued reps of SG 76 can be found in Ref. [9], which is partially reproduced in Table S3. Table S3 also lists the corresponding part of the established single-valued coreps of type II MSG 76. We present the defining relations and the character tables of two related abstract groups  $G_1^1$  and  $G_4^1$  in Table S4. The BZ of SG 76 is shown in Fig. S6, along with the labels of high-symmetry points and high-symmetry lines. The single-valued reps describes the spinless systems or the systems with negligible SOC effect, where a  $2\pi$  rotation equals to identity operator and  $\mathcal{T}^2 = 1$ . We discuss the high-symmetry points  $\Gamma$  and  $R$ , and high-symmetry line  $U$  in turn.

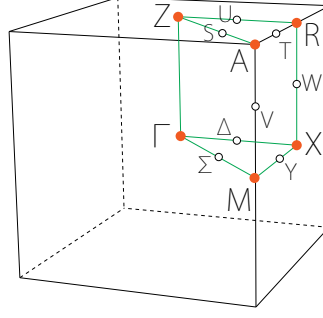


FIG. S6. BZ of SG 76 and SG 92. We adopt the notation of Ref. [9] to label the high-symmetry points and high-symmetry lines.

TABLE S3. Part of single-valued reps of SG 76 (reproduced from Ref. [9]) and the corresponding single-valued coreps of type II MSG 76 (see Sec. S7). For the left part, the columns from left to right list the high-symmetry momentum  $\mathbf{k}_1$ , the little group at  $\mathbf{k}_1$ :  $\mathbf{G}^{\mathbf{k}_1}$  (presented as an abstract group  $\mathbf{G}_{|\mathbf{G}|}^n$ ), the generating elements of  $\mathbf{G}^{\mathbf{k}_1}$  and a series of code  $(R_i, j)$  separated by semicolons.  $R_i$  is the rep of  $\mathbf{G}_{|\mathbf{G}|}^n$  corresponding to an allowed rep  $\Gamma_p^{\mathbf{k}_1}$  of  $\mathbf{G}^{\mathbf{k}_1}$ , and the integer  $j$  denotes the reality of the induced SG reps  $\Gamma_p^{\mathbf{k}_1} \uparrow \mathbf{G}$ . For the right part, the columns from left to right list  $\mathbf{k}_1$ , the position of  $\mathbf{k}_1$ , the generating elements of the little group at  $\mathbf{k}_1$  (only point-group operator of the elements are presented), the corep derived from the corresponding  $\Gamma_p^{\mathbf{k}_1}(R_i)$ , the dimension of the corep, the matrix representations of the generating elements, the species and the topological charge of the degeneracies.

SG 76		type II MSG 76					
$\Gamma$	$G_4^1: \{C_{4z}^+   00\frac{1}{4}\}: R_1, 1; R_2, 3; R_3, 1; R_4, 3.$	$\Gamma; (000)$	$C_{4z}^+, \mathcal{T};$	$R_1;$	$1;$	$1, 1;$	
				$\{R_2, R_4\};$	$2;$	$i\sigma_3, \sigma_1;$	C-2 WP; 2
				$R_3;$	$1;$	$-1, 1;$	
$R$	$G_4^1: \{C_{2z}^+   00\frac{1}{2}\}: R_2, 3; R_4, 3.$	$R; (0\frac{1}{2}\frac{1}{2})$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, \sigma_1;$	P-NS <sub>ZAR</sub> ;
$U$	$G_1^1: (E, 0): R_1, 2.$	$U; \text{ZR}$	$E, C_{2z}\mathcal{T};$	$\{R_1, R_1\};$	$2;$	$\sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;

TABLE S4. The defining relation and character tables of abstract groups  $G_1^1$  and  $G_4^1$  (reproduced from Ref. [9]).

$G_1^1$		$G_4^1$				
$C_1 = E$		$P^4 = E$				
		$C_1 = E; C_2 = P; C_3 = P^2; C_4 = P^3.$				
	$C_1$		$C_1$	$C_2$	$C_3$	$C_4$
$R_1$	1	$R_1$	1	1	1	1
		$R_2$	1	$i$	-1	$-i$
		$R_3$	1	-1	1	-1
		$R_4$	1	$-i$	-1	$i$

$\Gamma: \mathbf{k} = (000).$

As shown in the left part of Table S3,  $\mathbf{G}^\Gamma$ , the (Herring) little group at  $\Gamma$  point in SG 76, is abstract group  $G_4^1$ , which is isomorphic to point group  $C_4$ , and its generating element is  $P = \{C_{4z}^+ | 00\frac{1}{4}\}$ . After generating element is a series of code  $(R_i, j)$  separated by semicolons.  $R_i$  is the rep of abstract group  $G_4^1$  corresponding to an allowed rep  $\Gamma_p^\Gamma$  of  $\mathbf{G}^\Gamma$ , and the integer  $j$  denotes the reality of the induced SG reps  $\Gamma_p^\Gamma \uparrow \mathbf{G}$ . Since  $\Gamma$  is invariant under  $\mathcal{T}$  symmetry, the little group  $\mathbf{M}^\Gamma$  of type II MSG 76 is

$$\mathbf{M}^\Gamma = \mathbf{G}^\Gamma + \mathcal{T}\mathbf{G}^\Gamma, \quad (\text{S51})$$

which indicates the generating elements of  $\mathbf{M}^\Gamma$  can be chosen as  $P$  ( $\{C_{4z}^+|00\frac{1}{4}\}$ ) and  $\mathcal{T}$ .

All the four 1D reps of  $G_4^1$  are the allowed reps of  $\mathbf{G}^\Gamma$ . For  $R_1$  rep, it belongs to Case (a), as the reality of its induced SG rep is 1. According to the discussions in Sec. S4B, the solution of  $\mathbf{N}$  can be calculated as

$$\mathbf{N} = 1. \quad (\text{S52})$$

Then the matrix representations of the generating elements in  $\mathbf{M}^\Gamma$  for the corep derived from  $R_1$  are

$$\mathbf{D}_1(P) = \mathbf{\Delta}_1(P) = 1, \quad \mathbf{D}_1(\mathcal{T}) = \mathbf{N} = 1, \quad (\text{S53})$$

which are listed in the right part of Table S3.

For  $R_2$  rep, it belongs to Case (c), as the reality of its induced SG rep is 3. Hence, the  $\mathcal{T}$  symmetry makes  $R_2$  and one another rep degenerate in energy. A direct calculation gives the matrix representations of the corep derived from  $R_2$ ,

$$\mathbf{D}_2(P) = \begin{bmatrix} \mathbf{\Delta}_2(P) & 0 \\ 0 & \mathbf{\Delta}_2^*(\mathcal{T}^{-1}P\mathcal{T}) \end{bmatrix} = \begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix} = i\sigma_3, \quad \mathbf{D}_2(\mathcal{T}) = \begin{bmatrix} 0 & \mathbf{\Delta}(\mathcal{T}^2) \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} = \sigma_1. \quad (\text{S54})$$

One can find that the matrix trace of  $\mathbf{\Delta}_2^*(\mathcal{T}^{-1}R\mathcal{T})$  is identical to that of  $\mathbf{\Delta}_4(R)$  with  $R$  the element of  $\mathbf{G}^\Gamma$ , indicating that the rep degenerate with  $R_2$  is  $R_4$ . Actually, in the present simple case, we can easily figure it out, as only  $R_2$  and  $R_4$  belong to Case (c).

We then discuss the physics underneath the degeneracy between  $R_2$  and  $R_4$ . Since  $\Gamma$  point has  $P = \{C_{4z}^+|00\frac{1}{4}\}$  symmetry, the basis state of electronic bands at  $\Gamma$  point can be chosen as the eigenstates of  $P$ , denoted as  $|c_{4z}\rangle$  with  $c_{4z} = \pm i, \pm 1$  as  $P^4 = 1$ . One observes that

$$PT|\pm i\rangle = \mathcal{T}P|\pm i\rangle = \mp i(\mathcal{T}|\pm i\rangle), \quad (\text{S55})$$

which means that  $\mathcal{T}|\pm i\rangle = |\mp i\rangle$  and hence the two states  $|i\rangle$  ( $R_2$ ) and  $|-i\rangle$  ( $R_4$ ) would be degenerate due to the addition of  $\mathcal{T}$  symmetry. The low-energy  $k \cdot p$  Hamiltonian expanded around this double degeneracy with  $\{R_2, R_4\}$  rep is

$$H = c_1 + c_2k^2 + c_3k_z^2 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)]\sigma_i + c_4\sigma_3k_z, \quad (\text{S56})$$

from which we know the double degeneracy is a C-2 WP with a topological charge  $|\mathcal{C}| = 2$ , as listed in Table S3.

For  $R_3$  rep, it belongs to Case (a), as the reality of its induced SG rep is 1. The solution of  $\mathbf{N}$  can be calculated as

$$\mathbf{N} = 1, \quad (\text{S57})$$

and the matrix representations of the corep derived from  $R_3$  are obtained as

$$\mathbf{D}_3(P) = \mathbf{\Delta}_3(P) = 1, \quad \mathbf{D}_3(\mathcal{T}) = \mathbf{N} = 1. \quad (\text{S58})$$

$R$ :  $\mathbf{k} = (0\frac{1}{2}\frac{1}{2})$ .

$R$  is invariant under  $\mathcal{T}$  symmetry and the little group  $\mathbf{M}^R$  is

$$\mathbf{M}^R = \mathbf{G}^R + \mathcal{T}\mathbf{G}^R. \quad (\text{S59})$$

$\mathbf{G}^R$  also is abstract group  $G_4^1$ , and its generating element is  $P = \{C_{2z}|00\frac{1}{2}\}$ . Since  $R$  locates at the BZ boundary, one has  $P^2 = -1$  at  $R$  point, due to the presence of fraction translation in  $P$ . Consequently, only two of the four 1D reps of  $G_4^1$ ,  $R_2$  and  $R_4$ , are the allowed reps of  $\mathbf{G}^R$ . Both  $R_2$  and  $R_4$  belong to Case (c), indicating they would degenerate in energy with the addition of  $\mathcal{T}$  symmetry. We use  $R_2$  to calculate the coreps, obtained as

$$\mathbf{D}_2(P) = \begin{bmatrix} \mathbf{\Delta}_2(P) & 0 \\ 0 & \mathbf{\Delta}_2^*(\mathcal{T}^{-1}P\mathcal{T}) \end{bmatrix} = \begin{bmatrix} i & 0 \\ 0 & -i \end{bmatrix} = i\sigma_3, \quad \mathbf{D}_2(\mathcal{T}) = \begin{bmatrix} 0 & \mathbf{\Delta}(\mathcal{T}^2) \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} = \sigma_1. \quad (\text{S60})$$

The physics underneath the degeneracy is that the electronic bands with reps  $R_2$  and  $R_4$  respectively correspond to the electronic states of  $|p=i\rangle$  and  $|p=-i\rangle$ , where  $|p\rangle$  is the eigenstate of  $P$ , and one has

$$PT|\pm i\rangle = \mathcal{T}P|\pm i\rangle = \mp i(\mathcal{T}|\pm i\rangle). \quad (\text{S61})$$

This means that  $\mathcal{T}|\pm i\rangle = |\mp i\rangle$  and the two states  $|i\rangle$  ( $R_2$ ) and  $|-i\rangle$  ( $R_4$ ) would be degenerate. The low-energy  $k \cdot p$  Hamiltonian (up to first order) expanded around this double degeneracy is

$$H = c_1 + c_2\sigma_3k_z. \quad (\text{S62})$$

A careful analysis shows this degeneracy is not isolate but a point in a nodal surface locating at  $ZAR$  plane ( $\text{P-NS}_{ZAR}$ ), which will be further discussed below in detail. The corep information and the analysis of the degeneracy at  $R$  point are listed in the right part of Table S3.

$U$ :  $\mathbf{k} = (0\alpha\frac{1}{2})$  with  $\alpha \in (0, \frac{1}{2})$ ,  $ZR$  path.

$U$  is invariant under  $\mathcal{A} = \{C_{2z}|00\frac{1}{2}\}\mathcal{T}$  symmetry and the little group  $\mathbf{M}^U$  is

$$\mathbf{M}^U = \mathbf{G}^U + \mathcal{A}\mathbf{G}^U. \quad (\text{S63})$$

$\mathbf{G}^U$  is  $G_1^1$ , and its generating element is  $P = (E, 0)$ . The  $R_1$  rep of  $G_1^1$  is the allowed reps of  $\mathbf{G}^U$ . It belongs to Case (b), as the reality of its induced SG reps is 2, which indicates that there exists a nodal line along  $U$  ( $ZR$  path) formed by the two electronic bands with same rep ( $R_1$ ). For  $R_1$  rep, the matrix representation of  $\{E|000\}$  is

$$\Delta_1(\{E|000\}) = \Delta_1(P)e^{-i2\pi\mathbf{k} \cdot (000)}e^{-i2\pi \times (0/g)} = \Delta_1(P), \quad (\text{S64})$$

where  $g = 1$  is determined by the factor system for the projected representation of  $\mathbf{G}^U$ . Since  $\mathcal{A}^2 = -1$  on  $U$ , we have

$$\mathbf{N} = 1, \quad (\text{S65})$$

and the matrix representations of the corep derived from  $R_1$  are

$$\mathbf{D}_1(P) = \begin{bmatrix} \Delta_1(P) & 0 \\ 0 & \Delta_1(P) \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \sigma_0, \quad \mathbf{D}_1(\mathcal{A}) = \begin{bmatrix} 0 & -\mathbf{N} \\ \mathbf{N} & 0 \end{bmatrix} = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} = -i\sigma_2. \quad (\text{S66})$$

We then discuss the physics of the degeneracy along high-symmetry line  $U$ . While  $\mathcal{T}^2 = 1$  for spinless systems, the anti-unitary operator  $\mathcal{A}^2 = -1$  on  $U$ , due to the half-integer translation following  $C_{2z}$ . This inevitably leads to Kramers-like degeneracies. Specifically, we can denote the eigenstate  $|e\rangle$  by the eigenvalue of  $\{E|000\}$ , and then the two states  $|e = 1\rangle$  ( $R_1$ ) and  $\mathcal{A}|e = 1\rangle$  ( $R_1$ ) are linearly independent and would be degenerate in energy, due to  $\mathcal{A}^2 = -1$ . In fact, all these points in  $ZAR$  plane have  $\mathcal{A}$  symmetry and  $\mathcal{A}^2 = -1$ , which eventually leads to a nodal surface at  $ZAR$  plane [3]. Thus, the nodal line along  $U$  is not isolated but resides in a nodal surface locating at  $ZAR$  plane (labelled as  $\text{L-NS}_{ZAR}$  in Table S3). The low-energy  $k \cdot p$  Hamiltonian (up to first order) expanded around a generic point on  $U$  is

$$H = c_1 + c_2k_x + c_3k_y + \sum_{i=1}^3 c_{i,1}\sigma_i k_z. \quad (\text{S67})$$

## 2. Double-valued coreps of type II MSG 92

The double-valued reps of SG 92 can be found in Ref. [9], which is partially reproduced in Table S5. Table S5 also lists the corresponding part of the established double-valued coreps of type II MSG 92. We present some relevant reps information of the related abstract groups  $G_8^2$ ,  $G_{14}^{16}$  and  $G_{32}^{11}$  in Table S6. The BZ of SG 92 is same with that of SG 76, and is shown in Fig. S6. The double-valued reps describe the systems with strong SOC effect, where a  $2\pi$  rotation leads to a minus sign and  $\mathcal{T}^2 = -1$ . We discuss the high-symmetry points  $\Gamma$  and  $M$ , and high-symmetry lines  $Y$  and  $T$  in turn.

TABLE S5. Part of double-valued reps of SG 92 (reproduced from Ref. [9]) and the corresponding double-valued coreps of type II MSG 92 (see Sec. S7).

SG 92	type II MSG 92
$\Gamma$ $G_{16}^{14}$ : $\{C_{4z}^+ 00\frac{1}{4}\}, \{C_{2x} \frac{1}{2}\frac{1}{2}0\}$ : $R_6, 2; R_7, 2$ .	$\Gamma$ ; (000) $C_{4z}^+, C_{2x}, \mathcal{T}$ ; $R_6$ ; $2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1 $R_7$ ; $2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$M$ $G_{32}^{11}$ : $\{C_{4z}^+ 00\frac{1}{4}\}, \{C_{2x} \frac{1}{2}\frac{1}{2}0\}$ : $R_6, 3; R_7, 3$ .	$M$ ; $(\frac{1}{2}\frac{1}{2}0)$ $C_{4z}, C_{2x}, \mathcal{T}$ ; $\{R_6, R_7\}$ ; 4; $\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; C-2 DP; 2
$Y$ $G_8^2$ : $(C_{2x}, 0), (E, 1)$ : $R_5, 3; R_7, 3$ .	$Y$ ; XM $C_{2x}, E, C_{2y}\mathcal{T}$ ; $\{R_5, R_7\}$ ; 2; $-i\sigma_3, \sigma_0, -i\sigma_2$ ; L-NS $_{ZAR}$ ;
$T$ $G_8^2$ : $(C_{2x}, 0), (E, 1)$ : $R_5, 1; R_7, 1$ .	$T$ ; RA $C_{2x}, E, C_{2y}\mathcal{T}$ ; $\{R_5, R_5\}$ ; 2; $-i\sigma_0, \sigma_0, -i\sigma_2$ ; L-NSs; $\{R_7, R_7\}$ ; 2; $i\sigma_0, \sigma_0, -i\sigma_2$ ; L-NSs;



TABLE S6. The defining relation and the matrix representation of the generating elements of abstract groups  $G_8^2$ ,  $G_{16}^{14}$  and  $G_{32}^{11}$  (reproduced from Ref. [9]).

$G_8^2$ $P^4 = E; Q^2 = E;$ $QP = PQ.$			$G_{16}^{14}$ $P^8 = E; Q^4 = E;$ $QP = P^7Q.$			$G_{32}^{11}$ $P^8 = E; Q^4 = E;$ $QP = P^3Q^3; Q^2P = PQ^2.$		
	$P$	$Q$		$P$	$Q$		$P$	$Q$
$R_5$	1	-1	$R_6$	$\frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix}$	$i \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$	$R_6$	$\frac{1}{\sqrt{2}} \begin{bmatrix} i & 1 \\ 1 & i \end{bmatrix}$	$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$
$R_7$	-1	-1	$R_7$	$\frac{1}{\sqrt{2}} \begin{bmatrix} -1 & 1 \\ -1 & -1 \end{bmatrix}$	$i \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$	$R_7$	$\frac{1}{\sqrt{2}} \begin{bmatrix} -i & 1 \\ 1 & -i \end{bmatrix}$	$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$

$\Gamma: \mathbf{k} = (000).$

$\Gamma$  is invariant under  $\mathcal{T}$  symmetry and the little group  $\mathbf{M}^\Gamma$  of type II double-valued MSG 92 is

$$\mathbf{M}^\Gamma = \mathbf{G}^\Gamma + \mathcal{T}\mathbf{G}^\Gamma. \quad (\text{S68})$$

$\mathbf{G}^\Gamma$  is abstract group  $G_{16}^{14}$ , which is isomorphic to point group  $D_4$ , and its generating elements are  $P = \{C_{4z}^+ | 00\frac{1}{4}\}$  and  $Q = \{C_{2x} | \frac{1}{2}\frac{1}{2}0\}$ . Only two 2D reps of  $G_{16}^{14}$ ,  $R_6$  and  $R_7$ , are the allowed reps of  $\mathbf{G}^\Gamma$ , as  $P^4 = Q^2 = -1$  at  $\Gamma$  point. For  $R_6$  rep, the reality of its induced SG rep is 2 and then it belongs to Case (a).

The solution of  $\mathbf{N}$  is

$$\mathbf{N} = -i\sigma_2, \quad (\text{S69})$$

as  $\mathcal{T}^2 = -1$  and  $R = \mathcal{T}^{-1}R\mathcal{T}$  for any element  $R$  in  $\mathbf{G}^\Gamma$ . Therefore, the matrix representations of the corep derived from  $R_6$  are

$$D_6(P) = \Delta_6(P) = \frac{1}{\sqrt{2}} \begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix} = \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \quad (\text{S70})$$

$$D_6(Q) = \Delta_6(Q) = i \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} = i\sigma_1, \quad (\text{S71})$$

$$D_6(\mathcal{T}) = \mathbf{N} = -i\sigma_2. \quad (\text{S72})$$

The low-energy Hamiltonian expanded around this double degeneracy is obtained as

$$H = c_1 + c_2k_z\sigma_2 + c_3(k_x\sigma_1 + k_y\sigma_3), \quad (\text{S73})$$

from which we know the degeneracy is a C-1 WP with a topological charge  $|\mathcal{C}| = 1$ , as listed in the right part of Table S5.

The  $R_7$  rep also belongs to Case (a). Similarly, the solution for  $\mathbf{N}$  is

$$\mathbf{N} = -i\sigma_2, \quad (\text{S74})$$

and we have

$$D_7(P) = \Delta_7(P) = \frac{1}{\sqrt{2}} \begin{bmatrix} -1 & 1 \\ -1 & -1 \end{bmatrix} = \frac{-\sigma_0 + i\sigma_2}{\sqrt{2}}, \quad (\text{S75})$$

$$D_7(Q) = \Delta_7(Q) = i \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} = i\sigma_1, \quad (\text{S76})$$

$$D_7(\mathcal{T}) = \mathbf{N} = -i\sigma_2. \quad (\text{S77})$$

The low-energy Hamiltonian expanded around this double degeneracy is

$$H = c_1 + c_2k_z\sigma_2 + c_3(k_x\sigma_1 - k_y\sigma_3), \quad (\text{S78})$$

from which we know this degeneracy also is a C-1 WP with a topological charge  $|\mathcal{C}| = 1$ , as listed in the right part of Table S5.

$M$ :  $\mathbf{k} = (\frac{1}{2}\frac{1}{2}0)$ .

$M$  is invariant under  $\mathcal{T}$  symmetry and the little group  $\mathbf{M}^M$  is

$$\mathbf{M}^M = \mathbf{G}^M + \mathcal{T}\mathbf{G}^M. \quad (\text{S79})$$

$\mathbf{G}^M$  is abstract group  $G_{32}^{11}$ , and its generating elements are identical with those of  $\Gamma$  point, namely,  $P = \{C_{4z}^+ | 00\frac{1}{4}\}$  and  $Q = \{C_{2x} | \frac{1}{2}\frac{1}{2}0\}$ . However, due to the presence of fractional translation in the generating elements, the commutation relation between  $P$  and  $Q$  at  $\Gamma$  and  $M$  points are completely different, as shown in Table S6. Only two 2D reps of  $G_{32}^{11}$ ,  $R_6$  and  $R_7$ , are the allowed reps of  $\mathbf{G}^M$ , due to the physical constraints of  $P^4 = -1$  and  $Q^2 = 1$  at  $M$  point. The two reps would degenerate in energy with the addition of  $\mathcal{T}$  symmetry, as they belong to Case (c). We use  $R_6$  to calculate the coreps, obtained as

$$D_6(P) = \begin{bmatrix} \Delta_6(P) & \mathbf{0} \\ \mathbf{0} & \Delta_6^*(\mathcal{T}^{-1}P\mathcal{T}) \end{bmatrix} = \begin{bmatrix} \Delta_6(P) & \mathbf{0} \\ \mathbf{0} & \Delta_6^*(P) \end{bmatrix} = \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \quad (\text{S80})$$

$$D_6(Q) = \begin{bmatrix} \Delta_6(Q) & \mathbf{0} \\ \mathbf{0} & \Delta_6^*(\mathcal{T}^{-1}Q\mathcal{T}) \end{bmatrix} = \begin{bmatrix} \Delta_6(Q) & \mathbf{0} \\ \mathbf{0} & \Delta_6^*(Q) \end{bmatrix} = \Gamma_{0,3}, \quad (\text{S81})$$

$$D_6(\mathcal{T}) = \begin{bmatrix} \mathbf{0} & \Delta(\mathcal{T}^2) \\ 1 & \mathbf{0} \end{bmatrix} = \begin{bmatrix} \mathbf{0} & -1 \\ 1 & \mathbf{0} \end{bmatrix} = -i\Gamma_{2,0}. \quad (\text{S82})$$

We then discuss the physics of the four-fold degeneracy with  $\{R_6, R_7\}$  rep. According to the defining relation of  $G_{32}^{11}$  and the constraints  $P^4 = -1$  and  $Q^2 = 1$ , we have the following algebra at  $M$  point

$$P^3Q^3 = P^3Q = QP. \quad (\text{S83})$$

The Bloch states at  $M$  can be chosen as the eigenstates of  $P$ , which we denote as  $|p\rangle$  with  $p = e^{\pm i\pi/4}$ ,  $e^{\pm i3\pi/4}$  due to  $P^4 = -1$ . Then, we have

$$P^3Q|p\rangle = QP|p\rangle = pQ|p\rangle, \quad (\text{S84})$$

which indicates that  $Q|e^{\pm i3\pi/4}\rangle \sim |e^{\pm i\pi/4}\rangle$  and  $Q|e^{\pm i\pi/4}\rangle \sim |e^{\pm i3\pi/4}\rangle$ . Hence, the two states  $|e^{i\pi/4}\rangle$  and  $|e^{i3\pi/4}\rangle$  would be degenerate, corresponding to rep  $R_6$ , as  $e^{i\pi/4} + e^{3i\pi/4} = \text{Tr}[\Delta_6(P)]$ . Similarly, the two states  $|e^{-i\pi/4}\rangle$  and  $|e^{-i3\pi/4}\rangle$  would be degenerate, corresponding to rep  $R_7$ , as  $e^{-i\pi/4} + e^{-3i\pi/4} = \text{Tr}[\Delta_7(P)]$ . Moreover, the state  $|e^{i\pi/4}\rangle$  and its time-reversal partner  $\mathcal{T}|e^{i\pi/4}\rangle = |e^{-i\pi/4}\rangle$ , as well as the state  $|e^{i3\pi/4}\rangle$  and its time-reversal partner  $\mathcal{T}|e^{i3\pi/4}\rangle = |e^{-i3\pi/4}\rangle$ , are linearly independent. Therefore, the four states  $\{|e^{i\pi/4}\rangle, |e^{i3\pi/4}\rangle, \mathcal{T}|e^{i\pi/4}\rangle, \mathcal{T}|e^{i3\pi/4}\rangle\}$  must be degenerate, leading to a four-fold degeneracy (formed by reps  $R_6$  and  $R_7$ ).

The low-energy Hamiltonian of this four-fold degeneracy is obtained as

$$H = c_1 + c_2k_z\Gamma_{3,1} + c_3(k_x\Gamma_{3,3} - k_y\Gamma_{0,2}) + [\alpha(k_x\Gamma_{+,0} + ik_y\Gamma_{+,1}) + h.c.], \quad (\text{S85})$$

from which we know this degeneracy is a C-2 DP with a topological charge  $|\mathcal{C}| = 2$ , as listed in the right part of Table S5. Here, we define  $\Gamma_{i,j} = \sigma_i \otimes \sigma_j$  with  $i, j = 0, 1, 2, 3, \pm$  and  $\sigma_{\pm} = (\sigma_1 \pm i\sigma_2)/2$ .

$Y$ :  $\mathbf{k} = (\alpha\frac{1}{2}0)$  with  $\alpha \in (0, \frac{1}{2})$ ,  $XM$  path.

$Y$  is invariant under  $\mathcal{A} = \{C_{2y} | \frac{1}{2}\frac{1}{2}\frac{1}{2}\}\mathcal{T}$  symmetry and the little group  $\mathbf{M}^Y$  is

$$\mathbf{M}^Y = \mathbf{G}^Y + \mathcal{A}\mathbf{G}^Y, \quad (\text{S86})$$

with  $\mathcal{A}^2 = -1$  at  $Y$ .  $\mathbf{G}^Y$  is  $G_8^2$ , and its generating element is  $P = (C_{2x}, 0)$  and  $Q = (E, 1)$ . Only two 1D reps of  $G_8^2$ ,  $R_5$  and  $R_7$ , are the allowed reps of  $\mathbf{G}^Y$ , due to the constraint  $\{C_{2x} | \frac{1}{2}\frac{1}{2}0\}^2 = \{\bar{E} | 100\} = -e^{-i2\pi\alpha}$  at  $Y$ . The two reps would degenerate in energy with the addition of  $\mathcal{A}$  symmetry, as they belong to Case (c). Then one has a nodal line along  $Y$  with  $\{R_5, R_7\}$  rep. For  $R_5$  and  $R_7$  reps, the matrix representation of  $\{C_{2x} | \frac{1}{2}\frac{1}{2}0\}$  and  $\{E | 000\}$  are [9]

$$\Delta_{5(\gamma)}(\{C_{2x} | \frac{1}{2}\frac{1}{2}0\}) = \Delta_{5(\gamma)}(P)e^{-i2\pi\mathbf{k} \cdot (\frac{1}{2}\frac{1}{2}0)}e^{-i2\pi \times (0/g)} = -ie^{-i\pi\alpha}\Delta_{5(\gamma)}(P), \quad (\text{S87})$$

$$\Delta_{5(\gamma)}(\{E | 000\}) = \Delta_{5(\gamma)}(Q)e^{-i2\pi\mathbf{k} \cdot (000)}e^{-i2\pi \times (1/g)} = -\Delta_{5(\gamma)}(Q), \quad (\text{S88})$$

where  $g = 2$  is determined by the factor system for the projected representation of  $\mathbf{G}^Y$ . One finds that the matrix rep  $\Delta_{5(7)}^2(\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}) = -e^{-i2\pi\alpha}\Delta_{5(7)}^2(P) = -e^{-i2\pi\alpha}$  satisfies the constraint  $\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}^2 = -e^{-i2\pi\alpha}$  at  $Y$ . We use rep  $R_5$  to calculate the coreps, obtained as

$$D_5(C_{2x}) = \begin{bmatrix} \Delta_5(\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}) & \mathbf{0} \\ \mathbf{0} & \Delta_5^*(\mathcal{A}^{-1}\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}\mathcal{A}) \end{bmatrix} = -ie^{-i\pi\alpha} \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} = -i\sigma_3 e^{-i\pi\alpha}, \quad (\text{S89})$$

$$D_5(E) = \begin{bmatrix} \Delta_5(\{E|000\}) & \mathbf{0} \\ \mathbf{0} & \Delta_5^*(\mathcal{A}^{-1}\{E|000\}\mathcal{A}) \end{bmatrix} = - \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} = \sigma_0, \quad (\text{S90})$$

$$D_5(\mathcal{A}) = \begin{bmatrix} \mathbf{0} & \Delta(\mathcal{A}^2) \\ 1 & \mathbf{0} \end{bmatrix} = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} = i\sigma_2. \quad (\text{S91})$$

Notice that, for simplification we omit the phase factor containing  $\alpha$ , e.g.  $e^{-i\pi\alpha}$ , in Table S5 and all the tables in Sec. S7 and Sec. S8.

We then discuss the physics of the degeneracy between  $R_5$  and  $R_7$  reps. First, as we have  $\mathcal{A}^2 = -1$  at  $Y$ , the electronic bands along this high-symmetry line are at least doubly degenerate due to the Kramers-like degeneracy. Then since  $\mathcal{A}^{-1}\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}\mathcal{A} = \{\bar{C}_{2x}|\frac{1}{2}\frac{1}{2}1\}$  and

$$\Delta_5(\mathcal{A}^{-1}\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}\mathcal{A}) = \Delta_5(\{\bar{C}_{2x}|\frac{1}{2}\frac{1}{2}1\}) = -\Delta_5(P)e^{-i2\pi\mathbf{k}\cdot(\frac{1}{2}\frac{1}{2}1)} = -ie^{i\pi\alpha}\Delta_5(P), \quad (\text{S92})$$

we have

$$\Delta_7(\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}) = \Delta_5^*(\mathcal{A}^{-1}\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}\mathcal{A}), \quad (\text{S93})$$

which means that the doubly degenerate bands is formed by the states with  $R_5$  and  $R_7$  reps.

Moreover, we find all the points in the boundary plane  $MARX$  have  $\mathcal{A}$  symmetry and  $\mathcal{A}^2 = -1$ . Hence, the nodal line along  $Y$  is not isolated but lie in a nodal surface locating at  $MARX$  plane (L-NS $_{MARX}$ ). The low-energy Hamiltonian expanded around a general point on  $Y$  is obtained as

$$H = c_1 + c_2 k_x + (c_3 \sigma_1 - c_4 \sigma_2) k_y. \quad (\text{S94})$$

$T$ :  $\mathbf{k} = (\alpha\frac{1}{2}\frac{1}{2})$  with  $\alpha \in (0, \frac{1}{2})$ .

$T$  also is invariant under  $\mathcal{A} = \{C_{2y}|\frac{1}{2}\frac{1}{2}2\}\mathcal{T}$  symmetry and the little group  $\mathbf{M}^T$  is

$$\mathbf{M}^T = \mathbf{G}^T + \mathbf{A}\mathbf{G}^T, \quad (\text{S95})$$

with  $\mathcal{A}^2 = -1$  at  $T$ .  $\mathbf{G}^T$  is  $G_8^2$ , and its generating element is  $P = (C_{2x}, 0)$  and  $Q = (E, 1)$ . Only two 1D reps of  $G_8^2$ ,  $R_5$  and  $R_7$ , are the allowed reps of  $\mathbf{G}^T$ , due to the constraint  $\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}^2 = \{E|100\} = -e^{-i2\pi\alpha}$  at  $T$ . Both two reps belong to Case (b), as the reality of their induced SG reps are 1, indicating there exist two different degenerate pairs:  $\{R_5, R_5\}$  and  $\{R_7, R_7\}$  at  $T$ . For  $R_{5(7)}$  rep, the matrix representation of  $\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}$  and  $\{E|000\}$  are

$$\Delta_{5(7)}(\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}) = \Delta_{5(7)}(P)e^{-i2\pi\mathbf{k}\cdot(\frac{1}{2}\frac{1}{2}0)}e^{-i2\pi\times(0/g)} = -ie^{-i\pi\alpha}\Delta_{5(7)}(P), \quad (\text{S96})$$

$$\Delta_{5(7)}(\{E|000\}) = \Delta_{5(7)}(Q)e^{-i2\pi\mathbf{k}\cdot(000)}e^{-i2\pi\times(1/g)} = -\Delta_{5(7)}(Q), \quad (\text{S97})$$

where  $g = 2$  is determined by the factor system for the projected representation of  $\mathbf{G}^T$ .

The double degeneracies at  $T$  also are Kramers-like degeneracies caused by  $\mathcal{A}^2 = -1$ . However, different from the case at  $Y$ , the electronic band at  $T$  with rep  $R_{5(7)}$  would be degenerate with the band with same rep. This is because that we have  $\mathcal{A}^{-1}\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}\mathcal{A} = \{\bar{C}_{2x}|\frac{1}{2}\frac{1}{2}1\}$  and

$$\Delta_{5(7)}(\mathcal{A}^{-1}\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}\mathcal{A}) = \Delta_{5(7)}(\{\bar{C}_{2x}|\frac{1}{2}\frac{1}{2}1\}) = -\Delta_{5(7)}(P)e^{-i2\pi\mathbf{k}\cdot(\frac{1}{2}\frac{1}{2}1)} = ie^{i\pi\alpha}\Delta_{5(7)}(P), \quad (\text{S98})$$

which leads to

$$\Delta_{5(7)}(\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}) = \Delta_{5(7)}^*(\mathcal{A}^{-1}\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}\mathcal{A}). \quad (\text{S99})$$

For  $R_5$ , the solution of  $\mathbf{N}$  matrix is

$$\mathbf{N} = 1. \quad (\text{S100})$$

and the deduced coreps are

$$D_5(C_{2x}) = \begin{bmatrix} \Delta_5(\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}) & \mathbf{0} \\ \mathbf{0} & \Delta_5(\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}) \end{bmatrix} = -ie^{-i\pi\alpha} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = -i\sigma_0 e^{-i\pi\alpha}, \quad (\text{S101})$$

$$D_5(E) = \begin{bmatrix} \Delta_5(\{E|000\}) & \mathbf{0} \\ \mathbf{0} & \Delta_5(\{E|000\}) \end{bmatrix} = - \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} = \sigma_0, \quad (\text{S102})$$

$$D_5(\mathcal{A}) = \begin{bmatrix} \mathbf{0} & -N \\ \mathbf{1} & \mathbf{0} \end{bmatrix} = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} = -i\sigma_2. \quad (\text{S103})$$

Again, for simplification we omit the phase factor containing  $\alpha$ , e.g.  $e^{-i\pi\alpha}$ , in Table S5 and all the tables in Sec. S7 and Sec. S8. Notice that  $T$  locates at the hinge of two boundary planes [ $MARX$  and  $ZAR$  plane], which both exhibit nodal surface. The nodal surface at  $ZAR$  plane is generated by the  $\{C_{2z}|00\frac{1}{2}\}\mathcal{T}$  symmetry. Therefore, the nodal line along  $T$  resides at the intersection of two nodal surface (which then is labelled as L-NSs in Table S5). The low-energy Hamiltonian expanded around a general point on the line with  $\{R_5, R_5\}$  rep is obtained as

$$H = c_1 + c_2 k_x + [(\alpha\sigma_+ + c_3\sigma_3)k_y k_z + h.c.]. \quad (\text{S104})$$

Similarly, the coreps deduced from  $R_7$  rep can be obtained as

$$D_7(C_{2x}) = \begin{bmatrix} \Delta_7(\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}) & \mathbf{0} \\ \mathbf{0} & \Delta_7(\{C_{2x}|\frac{1}{2}\frac{1}{2}0\}) \end{bmatrix} = -ie^{-i\pi\alpha} \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} = i\sigma_0 e^{-i\pi\alpha}, \quad (\text{S105})$$

$$D_7(E) = \begin{bmatrix} \Delta_7(\{E|000\}) & \mathbf{0} \\ \mathbf{0} & \Delta_7(\{E|000\}) \end{bmatrix} = - \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} = \sigma_0, \quad (\text{S106})$$

$$D_7(\mathcal{A}) = \begin{bmatrix} \mathbf{0} & -N \\ \mathbf{1} & \mathbf{0} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} = -i\sigma_2. \quad (\text{S107})$$

And the low-energy Hamiltonian expanded around a general point on the line with  $\{R_7, R_7\}$  rep is obtained as

$$H = c_1 + c_2 k_x + [(\alpha\sigma_+ + c_3\sigma_3)k_y k_z + h.c.]. \quad (\text{S108})$$

## S5. SPATIAL OPERATORS OF 230 SGS

We use the Seitz symbols  $\{\mathbf{R}|\mathbf{v}\}$  to express the elements of the space group, with  $\mathbf{R}$  a point-group operator and  $\mathbf{v}$  a translation vector following  $\mathbf{R}$ . The space group operator denoted by Seitz symbol is an active operator, that

$$\{\mathbf{R}|\mathbf{v}\} \mathbf{r} = \mathbf{R} \mathbf{r} + \mathbf{v}. \quad (\text{S109})$$

Reference [9] lists all the elements of the 32 point group labeled by the Schonflies notation in Tables 1.3, as well as the effect of  $\mathbf{R}$  acting on a generic vector  $(xyz)$  in Tables 1.4. In the following, we present all the elements (not including the elements of translation group) of each of 230 SGs based on the convention used in Ref. [9].

No.	Label	elements
1	$P1$	$\{E 000\}$
2	$P\bar{1}$	$\{E 000\}, \{I 000\}$
3	$P2$	$\{E 000\}, \{C_{2z} 000\}$
4	$P2_1$	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}$
5	$C2$	$\{E 000\}, \{C_{2z} 000\}$
6	$Pm$	$\{E 000\}, \{\sigma_z 000\}$
7	$Pc$	$\{E 000\}, \{\sigma_z \frac{1}{2}00\}$
8	$Cm$	$\{E 000\}, \{\sigma_z 000\}$
9	$Cc$	$\{E 000\}, \{\sigma_z \frac{1}{2}00\}$
10	$P2/m$	$\{E 000\}, \{C_{2z} 000\}, \{I 000\}, \{\sigma_z 000\}$
11	$P2_1/m$	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{I 00\frac{1}{2}\}, \{\sigma_z 000\}$
12	$C2/m$	$\{E 000\}, \{C_{2z} 000\}, \{I 000\}, \{\sigma_z 000\}$
13	$P2/c$	$\{E 000\}, \{C_{2z} 000\}, \{I \frac{1}{2}00\}, \{\sigma_z \frac{1}{2}00\}$
14	$P2_1/c$	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{I \frac{1}{2}0\frac{1}{2}\}, \{\sigma_z \frac{1}{2}00\}$
15	$C2/c$	$\{E 000\}, \{C_{2z} 000\}, \{I \frac{1}{2}00\}, \{\sigma_z \frac{1}{2}00\}$
16	$P222$	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}$
17	$P222_1$	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{2y} 000\}, \{C_{2x} 00\frac{1}{2}\}$
18	$P2_12_12$	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} \frac{1}{2}\frac{1}{2}0\}, \{C_{2x} \frac{1}{2}\frac{1}{2}0\}$
19	$P2_12_12_1$	$\{E 000\}, \{C_{2z} \frac{1}{2}0\frac{1}{2}\}, \{C_{2y} \frac{1}{2}\frac{1}{2}0\}, \{C_{2x} 0\frac{1}{2}\frac{1}{2}\}$
20	$C222_1$	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{2y} 00\frac{1}{2}\}, \{C_{2x} 000\}$
21	$C222$	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}$
22	$F222$	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}$
23	$I222$	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}$
24	$I2_12_12_1$	$\{E 000\}, \{C_{2z} \frac{1}{2}0\frac{1}{2}\}, \{C_{2y} \frac{1}{2}\frac{1}{2}0\}, \{C_{2x} 0\frac{1}{2}\frac{1}{2}\}$
25	$Pmm2$	$\{E 000\}, \{C_{2z} 000\}, \{\sigma_y 000\}, \{\sigma_x 000\}$
26	$Pmc2_1$	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{\sigma_y 00\frac{1}{2}\}, \{\sigma_x 000\}$
27	$Pcc2$	$\{E 000\}, \{C_{2z} 000\}, \{\sigma_y 00\frac{1}{2}\}, \{\sigma_x 00\frac{1}{2}\}$
28	$Pma2$	$\{E 000\}, \{C_{2z} \frac{1}{2}00\}, \{\sigma_y 000\}, \{\sigma_x \frac{1}{2}00\}$
29	$Pca2_1$	$\{E 000\}, \{C_{2z} \frac{1}{2}0\frac{1}{2}\}, \{\sigma_y 00\frac{1}{2}\}, \{\sigma_x \frac{1}{2}00\}$
30	$Pnc2$	$\{E 000\}, \{C_{2z} \frac{1}{2}00\}, \{\sigma_y 00\frac{1}{2}\}, \{\sigma_x \frac{1}{2}0\frac{1}{2}\}$
31	$Pmn2_1$	$\{E 000\}, \{C_{2z} \frac{1}{2}0\frac{1}{2}\}, \{\sigma_y 000\}, \{\sigma_x \frac{1}{2}0\frac{1}{2}\}$
32	$Pba2$	$\{E 000\}, \{C_{2z} \frac{1}{2}\frac{1}{2}0\}, \{\sigma_y 0\frac{1}{2}0\}, \{\sigma_x \frac{1}{2}00\}$
33	$Pna2_1$	$\{E 000\}, \{C_{2z} \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_y 0\frac{1}{2}\frac{1}{2}\}, \{\sigma_x \frac{1}{2}00\}$
34	$Pnn2$	$\{E 000\}, \{C_{2z} \frac{1}{2}\frac{1}{2}0\}, \{\sigma_y 0\frac{1}{2}\frac{1}{2}\}, \{\sigma_x \frac{1}{2}0\frac{1}{2}\}$
35	$Cmm2$	$\{E 000\}, \{C_{2z} 000\}, \{\sigma_y 000\}, \{\sigma_x 000\}$
36	$Cmc2_1$	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{\sigma_y 000\}, \{\sigma_x 00\frac{1}{2}\}$
37	$Ccc2$	$\{E 000\}, \{C_{2z} 000\}, \{\sigma_y 00\frac{1}{2}\}, \{\sigma_x 00\frac{1}{2}\}$
38	$Amm2$	$\{E 000\}, \{C_{2y} 000\}, \{\sigma_x 000\}, \{\sigma_z 000\}$
39	$Abm2$	$\{E 000\}, \{C_{2y} 000\}, \{\sigma_x \frac{1}{2}\frac{1}{2}0\}, \{\sigma_z \frac{1}{2}\frac{1}{2}0\}$
40	$Ama2$	$\{E 000\}, \{C_{2y} 000\}, \{\sigma_x 00\frac{1}{2}\}, \{\sigma_z 00\frac{1}{2}\}$

No.	Label	elements
41	<i>Aba2</i>	$\{E 000\}, \{C_{2y} 000\}, \{\sigma_x \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_z \frac{1}{2}\frac{1}{2}\frac{1}{2}\}$
42	<i>Fmm2</i>	$\{E 000\}, \{C_{2z} 000\}, \{\sigma_y 000\}, \{\sigma_x 000\}$
43	<i>Fdd2</i>	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{\sigma_y \frac{1}{2}00\}, \{\sigma_x 0\frac{1}{2}0\}$
44	<i>Imm2</i>	$\{E 000\}, \{C_{2z} 000\}, \{\sigma_y 000\}, \{\sigma_x 000\}$
45	<i>Iba2</i>	$\{E 000\}, \{C_{2z} 000\}, \{\sigma_y \frac{1}{2}\frac{1}{2}0\}, \{\sigma_x \frac{1}{2}\frac{1}{2}0\}$
46	<i>Ima2</i>	$\{E 000\}, \{C_{2z} 000\}, \{\sigma_y 0\frac{1}{2}\frac{1}{2}\}, \{\sigma_x 0\frac{1}{2}\frac{1}{2}\}$
47	<i>Pmmm</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{I 000\}, \{\sigma_z 000\}, \{\sigma_y 000\}, \{\sigma_x 000\}$
48	<i>Pnnn</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{I \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_z \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_y \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_x \frac{1}{2}\frac{1}{2}\frac{1}{2}\}$
49	<i>Pccm</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{I 00\frac{1}{2}\}, \{\sigma_z 00\frac{1}{2}\}, \{\sigma_y 00\frac{1}{2}\}, \{\sigma_x 00\frac{1}{2}\}$
50	<i>Pban</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{I \frac{1}{2}\frac{1}{2}0\}, \{\sigma_z \frac{1}{2}\frac{1}{2}0\}, \{\sigma_y \frac{1}{2}\frac{1}{2}0\}, \{\sigma_x \frac{1}{2}\frac{1}{2}0\}$
51	<i>Pmma</i>	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{2y} 000\}, \{C_{2x} 00\frac{1}{2}\}, \{I 000\}, \{\sigma_z 00\frac{1}{2}\}, \{\sigma_y 000\}, \{\sigma_x 00\frac{1}{2}\}$
52	<i>Pnna</i>	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{2y} 000\}, \{C_{2x} 00\frac{1}{2}\}, \{I \frac{1}{2}\frac{1}{2}0\}, \{\sigma_z \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_y \frac{1}{2}\frac{1}{2}0\}, \{\sigma_x \frac{1}{2}\frac{1}{2}\frac{1}{2}\}$
53	<i>Pmna</i>	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{2y} 000\}, \{C_{2x} 00\frac{1}{2}\}, \{I \frac{1}{2}00\}, \{\sigma_z \frac{1}{2}0\frac{1}{2}\}, \{\sigma_y \frac{1}{2}00\}, \{\sigma_x \frac{1}{2}0\frac{1}{2}\}$
54	<i>Pcca</i>	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{2y} 000\}, \{C_{2x} 00\frac{1}{2}\}, \{I 0\frac{1}{2}0\}, \{\sigma_z 0\frac{1}{2}\frac{1}{2}\}, \{\sigma_y 0\frac{1}{2}0\}, \{\sigma_x 0\frac{1}{2}\frac{1}{2}\}$
55	<i>Pbam</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} \frac{1}{2}\frac{1}{2}0\}, \{C_{2x} \frac{1}{2}\frac{1}{2}0\}, \{I 000\}, \{\sigma_z 000\}, \{\sigma_y \frac{1}{2}\frac{1}{2}0\}, \{\sigma_x \frac{1}{2}\frac{1}{2}0\}$
56	<i>Pccn</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} \frac{1}{2}\frac{1}{2}0\}, \{C_{2x} \frac{1}{2}\frac{1}{2}0\}, \{I \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_z \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_y 00\frac{1}{2}\}, \{\sigma_x 00\frac{1}{2}\}$
57	<i>Pbcm</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} \frac{1}{2}\frac{1}{2}0\}, \{C_{2x} \frac{1}{2}\frac{1}{2}0\}, \{I 0\frac{1}{2}0\}, \{\sigma_z 0\frac{1}{2}0\}, \{\sigma_y \frac{1}{2}00\}, \{\sigma_x \frac{1}{2}00\}$
58	<i>Pnnm</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} \frac{1}{2}\frac{1}{2}0\}, \{C_{2x} \frac{1}{2}\frac{1}{2}0\}, \{I 00\frac{1}{2}\}, \{\sigma_z 00\frac{1}{2}\}, \{\sigma_y \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_x \frac{1}{2}\frac{1}{2}\frac{1}{2}\}$
59	<i>Pmmn</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} \frac{1}{2}\frac{1}{2}0\}, \{C_{2x} \frac{1}{2}\frac{1}{2}0\}, \{I \frac{1}{2}\frac{1}{2}0\}, \{\sigma_z \frac{1}{2}\frac{1}{2}0\}, \{\sigma_y 000\}, \{\sigma_x 000\}$
60	<i>Pbcn</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} \frac{1}{2}\frac{1}{2}0\}, \{C_{2x} \frac{1}{2}\frac{1}{2}0\}, \{I \frac{1}{2}0\frac{1}{2}\}, \{\sigma_z \frac{1}{2}0\frac{1}{2}\}, \{\sigma_y 0\frac{1}{2}\frac{1}{2}\}, \{\sigma_x 0\frac{1}{2}\frac{1}{2}\}$
61	<i>Pbca</i>	$\{E 000\}, \{C_{2z} \frac{1}{2}0\frac{1}{2}\}, \{C_{2y} \frac{1}{2}\frac{1}{2}0\}, \{C_{2x} 0\frac{1}{2}\frac{1}{2}\}, \{I 000\}, \{\sigma_z \frac{1}{2}0\frac{1}{2}\}, \{\sigma_y \frac{1}{2}\frac{1}{2}0\}, \{\sigma_x 0\frac{1}{2}\frac{1}{2}\}$
62	<i>Pnma</i>	$\{E 000\}, \{C_{2z} \frac{1}{2}0\frac{1}{2}\}, \{C_{2y} \frac{1}{2}\frac{1}{2}0\}, \{C_{2x} 0\frac{1}{2}\frac{1}{2}\}, \{I \frac{1}{2}\frac{1}{2}0\}, \{\sigma_z 0\frac{1}{2}\frac{1}{2}\}, \{\sigma_y 000\}, \{\sigma_x \frac{1}{2}0\frac{1}{2}\}$
63	<i>Cmcm</i>	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{2y} 00\frac{1}{2}\}, \{C_{2x} 000\}, \{I 000\}, \{\sigma_z 00\frac{1}{2}\}, \{\sigma_y 00\frac{1}{2}\}, \{\sigma_x 000\}$
64	<i>Cmca</i>	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{2y} 00\frac{1}{2}\}, \{C_{2x} 000\}, \{I \frac{1}{2}\frac{1}{2}0\}, \{\sigma_z \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_y \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_x \frac{1}{2}\frac{1}{2}0\}$
65	<i>Cmmm</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{I 000\}, \{\sigma_z 000\}, \{\sigma_y 000\}, \{\sigma_x 000\}$
66	<i>Cccm</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{I 00\frac{1}{2}\}, \{\sigma_z 00\frac{1}{2}\}, \{\sigma_y 00\frac{1}{2}\}, \{\sigma_x 00\frac{1}{2}\}$
67	<i>Cmma</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{I \frac{1}{2}\frac{1}{2}0\}, \{\sigma_z \frac{1}{2}\frac{1}{2}0\}, \{\sigma_y \frac{1}{2}\frac{1}{2}0\}, \{\sigma_x \frac{1}{2}\frac{1}{2}0\}$
68	<i>Ccca</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{I \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_z \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_y \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_x \frac{1}{2}\frac{1}{2}\frac{1}{2}\}$
69	<i>Fmmm</i>	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{I 000\}, \{\sigma_z 000\}, \{\sigma_y 000\}, \{\sigma_x 000\}$
70	<i>Fddd</i>	$\{E 000\$

No.	Label	elements
81	$P\bar{4}$	$\{E 000\}, \{S_{4z}^+ 000\}, \{C_{2z} 000\}, \{S_{4z}^- 000\}$
82	$I\bar{4}$	$\{E 000\}, \{S_{4z}^+ 000\}, \{C_{2z} 000\}, \{S_{4z}^- 000\}$
83	$P4/m$	$\{E 000\}, \{C_{4z}^+ 000\}, \{C_{2z} 000\}, \{C_{4z}^- 000\}, \{I 000\}, \{S_{4z}^- 000\}, \{\sigma_z 000\}, \{S_{4z}^+ 000\}$
84	$P4_2/m$	$\{E 000\}, \{C_{4z}^+ 00\frac{1}{2}\}, \{C_{2z} 000\}, \{C_{4z}^- 00\frac{1}{2}\}, \{I 00\frac{1}{2}\}, \{S_{4z}^- 000\}, \{\sigma_z 00\frac{1}{2}\}, \{S_{4z}^+ 000\}$
85	$P4/n$	$\{E 000\}, \{C_{4z}^+ \frac{1}{2}\frac{1}{2}0\}, \{C_{2z} 000\}, \{C_{4z}^- \frac{1}{2}\frac{1}{2}0\}, \{I \frac{1}{2}\frac{1}{2}0\}, \{S_{4z}^- 000\}, \{\sigma_z \frac{1}{2}\frac{1}{2}0\}, \{S_{4z}^+ 000\}$
86	$P4_2/n$	$\{E 000\}, \{C_{4z}^+ \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{C_{2z} 000\}, \{C_{4z}^- \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{I \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{S_{4z}^- 000\}, \{\sigma_z \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{S_{4z}^+ 000\}$
87	$I4/m$	$\{E 000\}, \{C_{4z}^+ 000\}, \{C_{2z} 000\}, \{C_{4z}^- 000\}, \{I 000\}, \{S_{4z}^- 000\}, \{\sigma_z 000\}, \{S_{4z}^+ 000\}$
88	$I4_1/a$	$\{E 000\}, \{C_{4z}^+ \frac{3}{4}\frac{1}{4}\frac{1}{2}\}, \{C_{2z} 000\}, \{C_{4z}^- \frac{3}{4}\frac{1}{4}\frac{1}{2}\}, \{I \frac{3}{4}\frac{1}{4}\frac{1}{2}\}, \{S_{4z}^- 000\}, \{\sigma_z \frac{3}{4}\frac{1}{4}\frac{1}{2}\}, \{S_{4z}^+ 000\}$
89	$P422$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 000\}, \{C_{4z}^- 000\}, \{C_{2x} 000\}, \{C_{2y} 000\}, \{C_{2a} 000\}, \{C_{2b} 000\}$
90	$P42_12$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 000\}, \{C_{4z}^- 000\}, \{C_{2x} 0\frac{1}{2}\frac{1}{2}0\}, \{C_{2y} 0\frac{1}{2}\frac{1}{2}0\}, \{C_{2a} 0\frac{1}{2}\frac{1}{2}0\}, \{C_{2b} 0\frac{1}{2}\frac{1}{2}0\}$
91	$P4_122$	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{4z}^+ 00\frac{1}{4}\}, \{C_{4z}^- 00\frac{3}{4}\}, \{C_{2x} 000\}, \{C_{2y} 00\frac{1}{2}\}, \{C_{2a} 00\frac{1}{4}\}, \{C_{2b} 00\frac{3}{4}\}$
92	$P4_12_12$	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{4z}^+ 00\frac{1}{4}\}, \{C_{4z}^- 00\frac{3}{4}\}, \{C_{2x} 0\frac{1}{2}\frac{1}{2}0\}, \{C_{2y} 0\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{C_{2a} 0\frac{1}{2}\frac{1}{2}\frac{1}{4}\}, \{C_{2b} 0\frac{1}{2}\frac{1}{2}\frac{3}{4}\}$
93	$P4_222$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 00\frac{1}{2}\}, \{C_{4z}^- 00\frac{1}{2}\}, \{C_{2x} 000\}, \{C_{2y} 000\}, \{C_{2a} 00\frac{1}{2}\}, \{C_{2b} 00\frac{1}{2}\}$
94	$P4_22_12$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 00\frac{1}{2}\}, \{C_{4z}^- 00\frac{1}{2}\}, \{C_{2x} 0\frac{1}{2}\frac{1}{2}0\}, \{C_{2y} 0\frac{1}{2}\frac{1}{2}0\}, \{C_{2a} 0\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{C_{2b} 0\frac{1}{2}\frac{1}{2}\frac{1}{2}\}$
95	$P4_322$	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{4z}^+ 00\frac{3}{4}\}, \{C_{4z}^- 00\frac{1}{4}\}, \{C_{2x} 000\}, \{C_{2y} 00\frac{1}{2}\}, \{C_{2a} 00\frac{3}{4}\}, \{C_{2b} 00\frac{1}{4}\}$
96	$P4_32_12$	$\{E 000\}, \{C_{2z} 00\frac{1}{2}\}, \{C_{4z}^+ 00\frac{3}{4}\}, \{C_{4z}^- 00\frac{1}{4}\}, \{C_{2x} 0\frac{1}{2}\frac{1}{2}0\}, \{C_{2y} 0\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{C_{2a} 0\frac{1}{2}\frac{1}{2}\frac{3}{4}\}, \{C_{2b} 0\frac{1}{2}\frac{1}{2}\frac{1}{4}\}$
97	$I422$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 000\}, \{C_{4z}^- 000\}, \{C_{2x} 000\}, \{C_{2y} 000\}, \{C_{2a} 000\}, \{C_{2b} 000\}$
98	$I4_122$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ \frac{3}{4}\frac{1}{4}\frac{1}{2}\}, \{C_{4z}^- \frac{3}{4}\frac{1}{4}\frac{1}{2}\}, \{C_{2x} 0\frac{1}{2}\frac{1}{2}\}, \{C_{2y} 0\frac{1}{2}\frac{1}{2}\}, \{C_{2a} 0\frac{1}{4}\frac{1}{4}0\}, \{C_{2b} 0\frac{1}{4}\frac{1}{4}0\}$
99	$P4mm$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 000\}, \{C_{4z}^- 000\}, \{\sigma_y 000\}, \{\sigma_x 000\}, \{\sigma_{db} 000\}, \{\sigma_{da} 000\}$
100	$P4bm$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 000\}, \{C_{4z}^- 000\}, \{\sigma_y 0\frac{1}{2}\frac{1}{2}0\}, \{\sigma_x 0\frac{1}{2}\frac{1}{2}0\}, \{\sigma_{db} 0\frac{1}{2}\frac{1}{2}0\}, \{\sigma_{da} 0\frac{1}{2}\frac{1}{2}0\}$
101	$P4_2cm$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 00\frac{1}{2}\}, \{C_{4z}^- 00\frac{1}{2}\}, \{\sigma_y 00\frac{1}{2}\}, \{\sigma_x 00\frac{1}{2}\}, \{\sigma_{db} 000\}, \{\sigma_{da} 000\}$
102	$P4_2nm$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 00\frac{1}{2}\}, \{C_{4z}^- 00\frac{1}{2}\}, \{\sigma_y 0\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_x 0\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_{db} 0\frac{1}{2}\frac{1}{2}0\}, \{\sigma_{da} 0\frac{1}{2}\frac{1}{2}0\}$
103	$P4cc$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 000\}, \{C_{4z}^- 000\}, \{\sigma_y 00\frac{1}{2}\}, \{\sigma_x 00\frac{1}{2}\}, \{\sigma_{db} 00\frac{1}{2}\}, \{\sigma_{da} 00\frac{1}{2}\}$
104	$P4nc$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 000\}, \{C_{4z}^- 000\}, \{\sigma_y 0\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_x 0\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_{db} 0\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_{da} 0\frac{1}{2}\frac{1}{2}\frac{1}{2}\}$
105	$P4_2mc$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 00\frac{1}{2}\}, \{C_{4z}^- 00\frac{1}{2}\}, \{\sigma_y 000\}, \{\sigma_x 000\}, \{\sigma_{db} 00\frac{1}{2}\}, \{\sigma_{da} 00\frac{1}{2}\}$
106	$P4_2bc$	$\{E 000\}, \{C_{2z} 000\}, \{C_{4z}^+ 00\frac{1}{2}\}, \{C_{4z}^- 00\frac{1}{2}\}, \{\sigma$



[illegible]

No.	Label	elements
143	$P3$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}$
144	$P3_1$	$\{E 000\}, \{C_3^+ 00\frac{1}{3}\}, \{C_3^- 00\frac{2}{3}\}$
145	$P3_2$	$\{E 000\}, \{C_3^+ 00\frac{2}{3}\}, \{C_3^- 00\frac{1}{3}\}$
146	$R3$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}$
147	$P\bar{3}$	$\{E 000\}, \{S_6^+ 000\}, \{C_3^+ 000\}, \{I 000\}, \{C_3^- 000\}, \{S_6^- 000\}$
148	$R\bar{3}$	$\{E 000\}, \{S_6^+ 000\}, \{C_3^+ 000\}, \{I 000\}, \{C_3^- 000\}, \{S_6^- 000\}$
149	$P312$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 000\}, \{C'_{23} 000\}, \{C'_{22} 000\}$
150	$P321$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C''_{21} 000\}, \{C''_{23} 000\}, \{C''_{22} 000\}$
151	$P3_112$	$\{E 000\}, \{C_3^+ 00\frac{1}{3}\}, \{C_3^- 00\frac{2}{3}\}, \{C'_{21} 00\frac{2}{3}\}, \{C'_{23} 000\}, \{C'_{22} 00\frac{1}{3}\}$
152	$P3_121$	$\{E 000\}, \{C_3^+ 00\frac{1}{3}\}, \{C_3^- 00\frac{2}{3}\}, \{C''_{21} 00\frac{2}{3}\}, \{C''_{23} 000\}, \{C''_{22} 00\frac{1}{3}\}$
153	$P3_212$	$\{E 000\}, \{C_3^+ 00\frac{2}{3}\}, \{C_3^- 00\frac{1}{3}\}, \{C'_{21} 00\frac{1}{3}\}, \{C'_{23} 000\}, \{C'_{22} 00\frac{2}{3}\}$
154	$P3_221$	$\{E 000\}, \{C_3^+ 00\frac{2}{3}\}, \{C_3^- 00\frac{1}{3}\}, \{C''_{21} 00\frac{1}{3}\}, \{C''_{23} 000\}, \{C''_{22} 00\frac{2}{3}\}$
155	$R32$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 000\}, \{C'_{23} 000\}, \{C'_{22} 000\}$
156	$P3m1$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{\sigma_{v1} 000\}, \{\sigma_{v3} 000\}, \{\sigma_{v2} 000\}$
157	$P31m$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{\sigma_{d1} 000\}, \{\sigma_{d3} 000\}, \{\sigma_{d2} 000\}$
158	$P3c1$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{\sigma_{v1} 00\frac{1}{2}\}, \{\sigma_{v3} 00\frac{1}{2}\}, \{\sigma_{v2} 00\frac{1}{2}\}$
159	$P31c$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{\sigma_{d1} 00\frac{1}{2}\}, \{\sigma_{d3} 00\frac{1}{2}\}, \{\sigma_{d2} 00\frac{1}{2}\}$
160	$R3m$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{\sigma_{d1} 000\}, \{\sigma_{d3} 000\}, \{\sigma_{d2} 000\}$
161	$R3c$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{\sigma_{d1} \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_{d3} \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_{d2} \frac{1}{2}\frac{1}{2}\frac{1}{2}\}$
162	$P\bar{3}1m$	$\{E 000\}, \{I 000\}, \{S_6^+ 000\}, \{S_6^- 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 000\}, \{C'_{23} 000\}, \{C'_{22} 000\}, \{\sigma_{d2} 000\}, \{\sigma_{d1} 000\}, \{\sigma_{d3} 000\}$
163	$P\bar{3}1c$	$\{E 000\}, \{I 000\}, \{S_6^+ 000\}, \{S_6^- 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 00\frac{1}{2}\}, \{C'_{23} 00\frac{1}{2}\}, \{C'_{22} 00\frac{1}{2}\}, \{\sigma_{d2} 00\frac{1}{2}\}, \{\sigma_{d1} 00\frac{1}{2}\}, \{\sigma_{d3} 00\frac{1}{2}\}$
164	$P\bar{3}m1$	$\{E 000\}, \{I 000\}, \{S_6^+ 000\}, \{S_6^- 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 000\}, \{C'_{23} 000\}, \{C'_{22} 000\}, \{\sigma_{v2} 000\}, \{\sigma_{v1} 000\}, \{\sigma_{v3} 000\}$
165	$P\bar{3}c1$	$\{E 000\}, \{I 000\}, \{S_6^+ 000\}, \{S_6^- 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 00\frac{1}{2}\}, \{C'_{23} 00\frac{1}{2}\}, \{C'_{22} 00\frac{1}{2}\}, \{\sigma_{v2} 00\frac{1}{2}\}, \{\sigma_{v1} 00\frac{1}{2}\}, \{\sigma_{v3} 00\frac{1}{2}\}$
166	$R\bar{3}m$	$\{E 000\}, \{I 000\}, \{S_6^+ 000\}, \{S_6^- 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 000\}, \{C'_{23} 000\}, \{C'_{22} 000\}, \{\sigma_{d2} 000\}, \{\sigma_{d1} 000\}, \{\sigma_{d3} 000\}$
167	$R\bar{3}c$	$\{E 000\}, \{I 000\}, \{S_6^+ 000\}, \{S_6^- 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{C'_{23} \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{C'_{22} \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_{d2} \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_{d1} \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_{d3} \frac{1}{2}\frac{1}{2}\frac{1}{2}\}$
168	$P6$	$\{E 000\}, \{C_6^+ 000\}, \{C_3^+ 000\}, \{C_2 000\}, \{C_3^- 000\}, \{C_6^- 000\}$
169	$P6_1$	$\{E 000\}, \{C_6^+ 00\frac{1}{6}\}, \{C_3^+ 00\frac{1}{3}\}, \{C_2 00\frac{1}{2}\}, \{C_3^- 00\frac{2}{3}\}, \{C_6^- 00\frac{5}{6}\}$
170	$P6_5$	$\{E 000\}, \{C_6^+ 00\frac{5}{6}\}, \{C_3^+ 00\frac{2}{3}\}, \{C_2 00\frac{1}{2}\}, \{C_3^- 00\frac{1}{3}\}, \{C_6^- 00\frac{1}{6}\}$
171	$P6_2$	$\{E 000\}, \{C_6^+ 00\frac{1}{3}\}, \{C_3^+ 00\frac{2}{3}\}, \{C_2 000\}, \{C_3^- 00\frac{1}{3}\}, \{C_6^- 00\frac{2}{3}\}$
172	$P6_4$	$\{E 000\}, \{C_6^+ 00\frac{2}{3}\}, \{C_3^+ 00\frac{1}{3}\}, \{C_2 000\}, \{C_3^- 00\frac{2}{3}\}, \{C_6^- 00\frac{1}{3}\}$
173	$P6_3$	$\{E 000\}, \{C_6^+ 00\frac{1}{2}\}, \{C_3^+ 000\}, \{C_2 00\frac{1}{2}\}, \{C_3^- 000\}, \{C_6^- 00\frac{1}{2}\}$
174	$P\bar{6}$	$\{E 000\}, \{S_3^+ 000\}, \{C_3^- 000\}, \{\sigma_h 000\}, \{C_3^+ 000\}, \{S_3^- 000\}$
175	$P6/m$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C_2 000\}, \{C_6^- 000\}, \{C_6^+ 000\}, \{I 000\}, \{S_6^- 000\}, \{S_6^+ 000\}, \{\sigma_h 000\}, \{S_3^+ 000\}, \{S_3^- 000\}$
176	$P6_3/m$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C_2 00\frac{1}{2}\}, \{C_6^- 00\frac{1}{2}\}, \{C_6^+ 00\frac{1}{2}\}, \{I 00\frac{1}{2}\}, \{S_6^- 00\frac{1}{2}\}, \{S_6^+ 00\frac{1}{2}\}, \{\sigma_h 000\}, \{S_3^+ 000\}, \{S_3^- 000\}$

No. Label	elements
177 $P622$	$\{E 000\}, \{C_2 000\}, \{C_6^+ 000\}, \{C_6^- 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 000\}, \{C'_{23} 000\}, \{C'_{22} 000\}, \{C''_{22} 000\}, \{C''_{21} 000\}, \{C''_{23} 000\}$
178 $P6_122$	$\{E 000\}, \{C_2 00\frac{1}{2}\}, \{C_6^+ 00\frac{1}{6}\}, \{C_6^- 00\frac{5}{6}\}, \{C_3^+ 00\frac{1}{3}\}, \{C_3^- 00\frac{2}{3}\}, \{C'_{21} 000\}, \{C'_{23} 00\frac{1}{3}\}, \{C'_{22} 00\frac{2}{3}\}, \{C''_{22} 00\frac{1}{6}\}, \{C''_{21} 00\frac{1}{2}\}, \{C''_{23} 00\frac{5}{6}\}$
179 $P6_522$	$\{E 000\}, \{C_2 00\frac{1}{2}\}, \{C_6^+ 00\frac{5}{6}\}, \{C_6^- 00\frac{1}{6}\}, \{C_3^+ 00\frac{2}{3}\}, \{C_3^- 00\frac{1}{3}\}, \{C'_{21} 000\}, \{C'_{23} 00\frac{2}{3}\}, \{C'_{22} 00\frac{1}{3}\}, \{C''_{22} 00\frac{5}{6}\}, \{C''_{21} 00\frac{1}{2}\}, \{C''_{23} 00\frac{1}{6}\}$
180 $P6_222$	$\{E 000\}, \{C_2 000\}, \{C_6^+ 00\frac{1}{3}\}, \{C_6^- 00\frac{2}{3}\}, \{C_3^+ 00\frac{2}{3}\}, \{C_3^- 00\frac{1}{3}\}, \{C'_{21} 000\}, \{C'_{23} 00\frac{2}{3}\}, \{C'_{22} 00\frac{1}{3}\}, \{C''_{22} 00\frac{1}{3}\}, \{C''_{21} 000\}, \{C''_{23} 00\frac{2}{3}\}$
181 $P6_422$	$\{E 000\}, \{C_2 000\}, \{C_6^+ 00\frac{2}{3}\}, \{C_6^- 00\frac{1}{3}\}, \{C_3^+ 00\frac{1}{3}\}, \{C_3^- 00\frac{2}{3}\}, \{C'_{21} 000\}, \{C'_{23} 00\frac{1}{3}\}, \{C'_{22} 00\frac{2}{3}\}, \{C''_{22} 00\frac{2}{3}\}, \{C''_{21} 000\}, \{C''_{23} 00\frac{1}{3}\}$
182 $P6_322$	$\{E 000\}, \{C_2 00\frac{1}{2}\}, \{C_6^+ 00\frac{1}{2}\}, \{C_6^- 00\frac{1}{2}\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 000\}, \{C'_{23} 000\}, \{C'_{22} 000\}, \{C''_{22} 00\frac{1}{2}\}, \{C''_{21} 00\frac{1}{2}\}, \{C''_{23} 00\frac{1}{2}\}$
183 $P6mm$	$\{E 000\}, \{C_2 000\}, \{C_6^+ 000\}, \{C_6^- 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{\sigma_{v1} 000\}, \{\sigma_{v3} 000\}, \{\sigma_{v2} 000\}, \{\sigma_{d2} 000\}, \{\sigma_{d1} 000\}, \{\sigma_{d3} 000\}$
184 $P6cc$	$\{E 000\}, \{C_2 000\}, \{C_6^+ 000\}, \{C_6^- 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{\sigma_{v1} 00\frac{1}{2}\}, \{\sigma_{v3} 00\frac{1}{2}\}, \{\sigma_{v2} 00\frac{1}{2}\}, \{\sigma_{d2} 00\frac{1}{2}\}, \{\sigma_{d1} 00\frac{1}{2}\}, \{\sigma_{d3} 00\frac{1}{2}\}$
185 $P6_3cm$	$\{E 000\}, \{C_2 00\frac{1}{2}\}, \{C_6^+ 00\frac{1}{2}\}, \{C_6^- 00\frac{1}{2}\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{\sigma_{v1} 00\frac{1}{2}\}, \{\sigma_{v3} 00\frac{1}{2}\}, \{\sigma_{v2} 00\frac{1}{2}\}, \{\sigma_{d2} 000\}, \{\sigma_{d1} 000\}, \{\sigma_{d3} 000\}$
186 $P6_3mc$	$\{E 000\}, \{C_2 00\frac{1}{2}\}, \{C_6^+ 00\frac{1}{2}\}, \{C_6^- 00\frac{1}{2}\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{\sigma_{v1} 000\}, \{\sigma_{v3} 000\}, \{\sigma_{v2} 000\}, \{\sigma_{d2} 00\frac{1}{2}\}, \{\sigma_{d1} 00\frac{1}{2}\}, \{\sigma_{d3} 00\frac{1}{2}\}$
187 $P\bar{6}m2$	$\{E 000\}, \{\sigma_h 000\}, \{S_3^+ 000\}, \{S_3^- 000\}, \{C_3^- 000\}, \{C_3^+ 000\}, \{C'_{21} 000\}, \{C'_{22} 000\}, \{C'_{23} 000\}, \{\sigma_{v3} 000\}, \{\sigma_{v1} 000\}, \{\sigma_{v2} 000\}$
188 $P\bar{6}c2$	$\{E 000\}, \{\sigma_h 000\}, \{S_3^+ 000\}, \{S_3^- 000\}, \{C_3^- 000\}, \{C_3^+ 000\}, \{C'_{21} 00\frac{1}{2}\}, \{C'_{22} 00\frac{1}{2}\}, \{C'_{23} 00\frac{1}{2}\}, \{\sigma_{v3} 00\frac{1}{2}\}, \{\sigma_{v1} 00\frac{1}{2}\}, \{\sigma_{v2} 00\frac{1}{2}\}$
189 $P\bar{6}2m$	$\{E 000\}, \{\sigma_h 000\}, \{S_3^+ 000\}, \{S_3^- 000\}, \{C_3^- 000\}, \{C_3^+ 000\}, \{C''_{21} 000\}, \{C''_{22} 000\}, \{C''_{23} 000\}, \{\sigma_{d3} 000\}, \{\sigma_{d1} 000\}, \{\sigma_{d2} 000\}$
190 $P\bar{6}2c$	$\{E 000\}, \{\sigma_h 000\}, \{S_3^+ 000\}, \{S_3^- 000\}, \{C_3^- 000\}, \{C_3^+ 000\}, \{C'_{21} 00\frac{1}{2}\}, \{C'_{22} 00\frac{1}{2}\}, \{C'_{23} 00\frac{1}{2}\}, \{\sigma_{d3} 00\frac{1}{2}\}, \{\sigma_{d1} 00\frac{1}{2}\}, \{\sigma_{d2} 00\frac{1}{2}\}$
191 $P6/mmm$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 000\}, \{C'_{23} 000\}, \{C'_{22} 000\}, \{C_2 000\}, \{C_6^- 000\}, \{C_6^+ 000\}, \{C''_{21} 000\}, \{C''_{23} 000\}, \{C''_{22} 000\}, \{I 000\}, \{S_6^- 000\}, \{S_6^+ 000\}, \{\sigma_{d1} 000\}, \{\sigma_{d3} 000\}, \{\sigma_{d2} 000\}, \{\sigma_h 000\}, \{S_3^+ 000\}, \{S_3^- 000\}, \{\sigma_{v1} 000\}, \{\sigma_{v3} 000\}, \{\sigma_{v2} 000\}$
192 $P6/mcc$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 00\frac{1}{2}\}, \{C'_{23} 00\frac{1}{2}\}, \{C'_{22} 00\frac{1}{2}\}, \{C_2 000\}, \{C_6^- 000\}, \{C_6^+ 000\}, \{C''_{21} 00\frac{1}{2}\}, \{C''_{23} 00\frac{1}{2}\}, \{C''_{22} 00\frac{1}{2}\}, \{I 000\}, \{S_6^- 000\}, \{S_6^+ 000\}, \{\sigma_{d1} 00\frac{1}{2}\}, \{\sigma_{d3} 00\frac{1}{2}\}, \{\sigma_{d2} 00\frac{1}{2}\}, \{\sigma_h 000\}, \{S_3^+ 000\}, \{S_3^- 000\}, \{\sigma_{v1} 00\frac{1}{2}\}, \{\sigma_{v3} 00\frac{1}{2}\}, \{\sigma_{v2} 00\frac{1}{2}\}$
193 $P6_3/mcm$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 000\}, \{C'_{23} 000\}, \{C'_{22} 000\}, \{C_2 00\frac{1}{2}\}, \{C_6^- 00\frac{1}{2}\}, \{C_6^+ 00\frac{1}{2}\}, \{C''_{21} 00\frac{1}{2}\}, \{C''_{23} 00\frac{1}{2}\}, \{C''_{22} 00\frac{1}{2}\}, \{I 000\}, \{S_6^- 000\}, \{S_6^+ 000\}, \{\sigma_{d1} 000\}, \{\sigma_{d3} 000\}, \{\sigma_{d2} 000\}, \{\sigma_h 00\frac{1}{2}\}, \{S_3^+ 00\frac{1}{2}\}, \{S_3^- 00\frac{1}{2}\}, \{\sigma_{v1} 00\frac{1}{2}\}, \{\sigma_{v3} 00\frac{1}{2}\}, \{\sigma_{v2} 00\frac{1}{2}\}$
194 $P6_3/mmc$	$\{E 000\}, \{C_3^+ 000\}, \{C_3^- 000\}, \{C'_{21} 00\frac{1}{2}\}, \{C'_{23} 00\frac{1}{2}\}, \{C'_{22} 00\frac{1}{2}\}, \{C_2 00\frac{1}{2}\}, \{C_6^- 00\frac{1}{2}\}, \{C_6^+ 00\frac{1}{2}\}, \{C''_{21} 000\}, \{C''_{23} 000\}, \{C''_{22} 000\}, \{I 000\}, \{S_6^- 000\}, \{S_6^+ 000\}, \{\sigma_{d1} 00\frac{1}{2}\}, \{\sigma_{d3} 00\frac{1}{2}\}, \{\sigma_{d2} 00\frac{1}{2}\}, \{\sigma_h 00\frac{1}{2}\}, \{S_3^+ 00\frac{1}{2}\}, \{S_3^- 00\frac{1}{2}\}, \{\sigma_{v1} 000\}, \{\sigma_{v3} 000\}, \{\sigma_{v2} 000\}$
195 $P23$	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{C_{31}^+ 000\}, \{C_{34}^+ 000\}, \{C_{33}^+ 000\}, \{C_{32}^+ 000\}, \{C_{31}^- 000\}, \{C_{33}^- 000\}, \{C_{32}^- 000\}, \{C_{34}^- 000\}$
196 $F23$	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{C_{31}^+ 000\}, \{C_{34}^+ 000\}, \{C_{33}^+ 000\}, \{C_{32}^+ 000\}, \{C_{31}^- 000\}, \{C_{33}^- 000\}, \{C_{32}^- 000\}, \{C_{34}^- 000\}$
197 $I23$	$\{E 000\}, \{C_{2z} 000\}, \{C_{2y} 000\}, \{C_{2x} 000\}, \{C_{31}^+ 000\}, \{C_{34}^+ 000\}, \{C_{33}^+ 000\}, \{C_{32}^+ 000\}, \{C_{31}^- 000\}, \{C_{33}^- 000\}, \{C_{32}^- 000\}, \{C_{34}^- 000\}$
198 $P2_13$	$\{E 000\}, \{C_{2z} \frac{1}{2}0\frac{1}{2}\}, \{C_{2y} 0\frac{1}{2}\frac{1}{2}\}, \{C_{2x} \frac{1}{2}\frac{1}{2}0\}, \{C_{31}^+ 000\}, \{C_{34}^+ \frac{1}{2}\frac{1}{2}0\}, \{C_{33}^+ \frac{1}{2}0\frac{1}{2}\}, \{C_{32}^+ 0\frac{1}{2}\frac{1}{2}\}, \{C_{31}^- 000\}, \{C_{33}^- 0\frac{1}{2}\frac{1}{2}\}, \{C_{32}^- \frac{1}{2}\frac{1}{2}0\}, \{C_{34}^- \frac{1}{2}0\frac{1}{2}\}$
199 $I2_13$	$\{E 000\}, \{C_{2z} \frac{1}{2}0\frac{1}{2}\}, \{C_{2y} 0\frac{1}{2}\frac{1}{2}\}, \{C_{2x} \frac{1}{2}\frac{1}{2}0\}, \{C_{31}^+ 000\}, \{C_{34}^+ \frac{1}{2}\frac{1}{2}0\}, \{C_{33}^+ \frac{1}{2}0\frac{1}{2}\}, \{C_{32}^+ 0\frac{1}{2}\frac{1}{2}\}, \{C_{31}^- 000\}, \{C_{33}^- 0\frac{1}{2}\frac{1}{2}\}, \{C_{32}^- \frac{1}{2}\frac{1}{2}0\}, \{C_{34}^- \frac{1}{2}0\frac{1}{2}\}$

[illegible]

[illegible]

[illegible]

## S6. NOTATIONS AND DEFINED MATRICES USED IN SEC. S7 AND SEC. S8

### A. Notations

(i) We adopt the notations used in Ref. [9] to describe the information of SG and SG rep. The tables and figures in Ref. [9] that are relevant to this work is listed as follows.

- Figure 1.1-1.3: identifying the point-group operators;
- Figure 3.2-3.15: the BZ of each of the 14 Bravais lattices, along with the label of high symmetry momenta;
- Table 1.4: the effect of each point-group operator on a vector  $(xyz)$ ;
- Table 3.1 (3.3): list of all 14 Bravais lattice and the corresponding basic vectors in real (reciprocal) space;
- Table 3.6: list of the coordinates of high-symmetry point and line with respect to reciprocal vectors  $(\mathbf{g}_1\mathbf{g}_2\mathbf{g}_3)$ ;
- Table 5.1: defining relations, classes, character tables, and matrix representations of the relevant abstract groups;
- Table 5.7 (6.13): the single-valued (double-valued) reps of the 230 SGs;
- Table 6.7: the effect of point-group operators on spin.

It should be notice that there exist some typos in Ref. [9], which have been pointed out and corrected by Liu et al. [10]. We establish the corep tables of type II MSG based on the corrected results.

(ii) The momentum  $\mathbf{k}$  used in effective Hamiltonian of the degeneracies are referred to the right-hand orthogonal set of axes  $Ok_xk_yk_z$ . Moreover, we define

$$\{p_x, p_y, p_z\} = \frac{1}{\sqrt{12}} \left\{ -2\sqrt{2}k_x - \sqrt{2}k_y + \sqrt{2}k_z, \sqrt{6}k_y + \sqrt{6}k_z, 2k_x - 2k_y + 2k_z \right\}, \quad (\text{S110})$$

$$\{q_x, q_y, q_z\} = \frac{1}{\sqrt{12}} \left\{ -\sqrt{2}k_x - \sqrt{2}k_y + 2\sqrt{2}k_z, \sqrt{6}k_x - \sqrt{6}k_y, 2k_x + 2k_y + 2k_z \right\}, \quad (\text{S111})$$

which would appear in certain effective Hamiltonian. The coordinates of  $\mathbf{g}_1$ ,  $\mathbf{g}_2$  and  $\mathbf{g}_3$  with respect to  $k_x$ ,  $k_y$  and  $k_z$  axes for each Bravais lattice are listed in Table 3.3 of Ref. [9].

(iii) As discussed in Ref. [9], the reps of the little group ( $\mathbf{G}^{\mathbf{k}}$ ) for high-symmetry line are obtained with the aid of the central extension of the corresponding little co-group ( $\bar{\mathbf{G}}^{\mathbf{k}*}$ ). The relationship between the small reps  $\Gamma_p^{\mathbf{k}}$  of  $\mathbf{G}^{\mathbf{k}}$  and the reps  $\mathbf{D}_p^{\mathbf{k}}$  of  $\bar{\mathbf{G}}^{\mathbf{k}*}$  is

$$\Gamma_p^{\mathbf{k}}[\{R|\mathbf{v}\}] = e^{-i\mathbf{k}\cdot\mathbf{v}} \mathbf{D}_p^{\mathbf{k}}[(R, 0)], \quad (\text{S112})$$

with  $(R, \alpha)$  ( $\alpha$  an integer) the element of  $\bar{\mathbf{G}}^{\mathbf{k}*}$  (see sections 3.7 and 3.8 in Ref. [9]).

For the tables in Sec. S7 and Sec. S8, the matrix representation of generating elements on high-symmetry line are given in the form of  $\Gamma_p^{\mathbf{k}}[\{R|\mathbf{v}\}]$ . As the coordinate  $\mathbf{k}$  of high-symmetry line is a function of  $\alpha$  with  $0 < \alpha < \frac{1}{2}$  [such as the coordinate of  $T$  in SG 92 is  $\mathbf{k} = (\alpha\frac{1}{2}\frac{1}{2})$ ], then generally the matrix representation of  $\{R|\mathbf{v}\}$  for rep  $\Gamma_p^{\mathbf{k}}$  also is a function of  $\alpha$ . However, for the sake of simplicity, we omit the factor involving  $\alpha$  in the reps tables in Sec. S7 and Sec. S8, or in other word, we set  $\alpha = 0$  for the phase  $e^{-i\mathbf{k}\cdot\mathbf{v}}$ .

(iv) As discussed in Sec. S4B, there exist three possible cases (a-c) for the corep derived from a rep  $R_i$ . The corep is label as  $R_i$  for case (a),  $\{R_i, R_i\}$  for case (b) and  $\{R_i, R_j\}$  for case (c) in Sec. S7 and Sec. S8.

(v) Abbreviations used in the Tables of Sec. S7 and Sec. S8:

- NP/NL/NS: nodal point/line/surface;
- P-WNL<sub>AB</sub>: a nodal point resides on a Weyl nodal line, which occurs along high-symmetry line  $AB$ , or at the joint point of multiple Weyl nodal lines, which all connected to WNL<sub>AB</sub> by symmetry operators.
- P-WNL: a nodal point resides on a Weyl nodal line, which however does not occurs along any high-symmetry line;
- P-WNLs: a nodal point resides at the joint point of multiple Weyl nodal lines;



- P-DNL<sub>AB</sub>: a nodal point resides on a Dirac nodal line, which occurs along high-symmetry line  $AB$ , or at the joint point of multiple Dirac nodal lines, which all connected to DNL<sub>AB</sub> by symmetry operators.
- P-DNL: a nodal point resides on a Dirac nodal line, which however does not occurs along any high-symmetry line;
- P-DNLs: a nodal point resides at the joint point of multiple Dirac nodal lines;
- P-NS<sub>ABCD</sub>: a nodal point resides on a nodal surface, which occurs in high-symmetry plane  $ABCD$ ;
- P-NSs: a nodal point resides at the intersection of two or three nodal surfaces.
- P-WNL/NS: a nodal point resides at the intersection of a nodal line and a nodal surface.
- L-NS<sub>ABCD</sub>: a Weyl nodal line resides on a nodal surface, which occurs in high-symmetry plane  $ABCD$ ;
- L-NSs: a nodal line resides at the hinge of two nodal surfaces.

## B. Defined matrixes

### 1. Two-dimensional matrixes

We define

$$\sigma_0 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \sigma_1 = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \sigma_2 = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, \sigma_3 = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix},$$

$\sigma_{\pm} = (\sigma_1 \pm i\sigma_2)/2$  and

$$\begin{aligned} \sigma_4 &= \frac{-\sigma_0 + i(\sqrt{2}\sigma_1 + \sigma_2)}{2}, \sigma_5 = \frac{\sigma_1 - \sqrt{2}\sigma_2 - \sigma_3}{2i}, \sigma_6 = \frac{-\sigma_0 - i(\sigma_1 - \sigma_2 - \sigma_3)}{2}, \sigma_7 = \frac{i(\sigma_1 - \sigma_2 + \sigma_3)}{\sqrt{3}}, \\ \sigma_8 &= \frac{(3 + \sqrt{3})\sigma_1 - (\sqrt{3} - 3)\sigma_2 - 2\sqrt{3}\sigma_3}{6i}, \sigma_9 = \frac{((-1)^{1/3} - 1)\sigma_0 + (1 + (-1)^{1/3})\sigma_3}{2}, \\ \sigma_{10} &= \frac{(-1 - (-1)^{2/3})\sigma_0 + ((-1)^{2/3} - 1)\sigma_3}{2}, \sigma_{11} = \frac{(\sqrt{3} + 3i)\sigma_0 + (\sqrt{3} - i)\sigma_3}{4}, \\ \sigma_{12} &= \frac{(\sqrt{3} - i)\sigma_0 + (\sqrt{3} + 3i)\sigma_3}{4}, \sigma_{13} = \frac{2((-1)^{5/6} + i)\sigma_0 + (\sqrt{3} + i)\sigma_3}{4}, \\ \sigma_{14} &= \frac{2(-1)^{5/6}\sigma_0 + (\sqrt{3} + 3i)\sigma_3}{4}, \sigma_{15} = \frac{(\sqrt{3} + i)\sigma_0 + 2((-1)^{5/6} + i)\sigma_3}{4}, \\ \sigma_{16} &= \frac{-(-1)^{1/6}\sigma_0 + ((-1)^{5/6} + i)\sigma_3}{2}, \sigma_{17} = \frac{2(-1)^{5/6}\sigma_3 + (-\sqrt{3} - 3i)\sigma_0}{4}, \\ \sigma_{18} &= \frac{-2(-1)^{1/6}\sigma_3 + (\sqrt{3} - 3i)\sigma_0}{4}, \sigma_{19} = \frac{(\sqrt{3} - i)\sigma_0 - (\sqrt{3} + 3i)\sigma_3}{4}, \\ \sigma_{20} &= \frac{-2(-1)^{1/6}\sigma_0 + (\sqrt{3} - 3i)\sigma_3}{4}, \sigma_{21} = -\frac{\sigma_1 + \sigma_2 + \sigma_3}{\sqrt{3}}, \\ \sigma_{22} &= \frac{(3 - \sqrt{3})\sigma_1 - (3 + \sqrt{3})\sigma_2 + 2\sqrt{3}\sigma_3}{6}, \sigma_{23} = \frac{\sqrt{2}(\sqrt{3} - 3)\sigma_0 - 4i\sqrt{6}\sigma_1 + 2i\sqrt{3}(2 + \sqrt{3})\sigma_3}{12}, \\ \sigma_{24} &= \frac{(3 - \sqrt{3})\sigma_1 + (3 + \sqrt{3})\sigma_2 + 2\sqrt{3}\sigma_3}{6}, \\ \sigma_{25} &= \frac{(6 + 6i)\sigma_0 + (1 - i)[(\sqrt{3} - 3)\sigma_1 - (3 + \sqrt{3})\sigma_2 - 2\sqrt{3}\sigma_3]}{12}, \\ \sigma_{26} &= \frac{(-1 + i)[6i\sigma_0 + (\sqrt{3} - 3)\sigma_1 - (3 + \sqrt{3})\sigma_2 - 2\sqrt{3}\sigma_3]}{12}. \end{aligned}$$

## 2. Three-dimensional matrixes

We define

$$A_0 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}, A_1 = \begin{pmatrix} 0 & -i & 0 \\ i & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}, A_2 = \begin{pmatrix} 0 & 0 & -i \\ 0 & 0 & 0 \\ i & 0 & 0 \end{pmatrix}, A_3 = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & -i \\ 0 & i & 0 \end{pmatrix}, A_4 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix},$$

$$A_5 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 0 \end{pmatrix}, A_6 = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}, A_7 = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}, A_8 = \frac{1}{\sqrt{3}} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -2 \end{pmatrix},$$

and

$$A_9 = \frac{-iA_1 + iA_2 - iA_3 + A_4 + A_6 + A_7}{2}, A_{10} = -\frac{A_0}{3} - A_5 + \frac{A_8}{\sqrt{3}}, A_{11} = \frac{iA_1 - iA_2 + iA_3 + A_4 + A_6 + A_7}{2},$$

$$A_{12} = -\frac{A_0}{3} + A_4 + \frac{A_8}{\sqrt{3}}, A_{13} = -\frac{A_0}{3} + A_5 + \frac{A_8}{\sqrt{3}}, A_{14} = \frac{A_7 + i[A_1 - A_2 - A_3 + i(A_4 + A_6)]}{2},$$

$$A_{15} = A_6 + \frac{-2A_0 + 3A_5 - \sqrt{3}A_8}{6}, A_{16} = -\frac{A_0}{3} + iA_1 + \frac{A_8}{\sqrt{3}}, A_{17} = A_7 + \frac{2A_0 + 3A_5 + \sqrt{3}A_8}{6},$$

$$A_{18} = \frac{2A_0 + 6iA_2 - 3A_5 + \sqrt{3}A_8}{6}, A_{19} = \frac{2A_0 - 6iA_3 + 3A_5 + \sqrt{3}A_8}{6}, A_{20} = \frac{A_0}{3} + A_4 - \frac{A_8}{\sqrt{3}},$$

$$A_{21} = \frac{2A_0 - 6iA_2 - 3A_5 + \sqrt{3}A_8}{6}, A_{22} = \frac{A_1 + A_2 + A_3 - i(A_4 - A_6 + A_7)}{2i},$$

$$A_{23} = \frac{(-2 - 2i\sqrt{3})A_0 - 12(-1)^{5/6}A_2 + (3 + 3i\sqrt{3})A_5 - (\sqrt{3} + 3i)A_8}{12},$$

$$A_{24} = \frac{-2i\sqrt{3}A_3 - 3A_5 - \sqrt{3}A_8}{4}, A_{25} = \frac{4A_0 - 3(\sqrt{3} + 3i)A_1 + 6[1 + (-1)^{2/3}]A_4 - 4\sqrt{3}A_8}{12},$$

$$A_{26} = \frac{2A_0 + (3 - 3i)A_5 + \sqrt{-24 + 18i}A_8}{6}, A_{27} = -\frac{A_0}{3} + iA_5 + \frac{A_8}{\sqrt{3}}, A_{28} = \frac{i(A_0 + 3iA_5 - \sqrt{3}A_8)}{3},$$

$$A_{29} = \frac{2A_0 + 6iA_3 + 3A_5 + \sqrt{3}A_8}{6}, A_{30} = A_7 + \frac{i(2A_0 + 3A_5 + \sqrt{3}A_8)}{6},$$

$$A_{31} = A_7 - \frac{i(2A_0 + 3A_5 + \sqrt{3}A_8)}{6}, A_{32} = \frac{2A_0 + (3 + 3i)A_5 + \sqrt{-24 - 18i}A_8}{6},$$

$$A_{33} = \frac{-2((-1)^{2/3} - 1)A_5 + (\sqrt{3} + 3i)A_8}{4}, A_{34} = \frac{4A_0 + 3(\sqrt{3} - 3i)A_3 + 6A_5 - 6((-1)^{1/3} - 1)A_7 + 2\sqrt{3}A_8}{12},$$

$$A_{35} = \frac{8A_0 - 6(\sqrt[3]{-1} - 1)A_5 + (\sqrt{3} + 9i)A_8}{12}, A_{36} = \frac{-2i\sqrt{3}A_3 + 3A_5 + \sqrt{3}A_8}{4},$$

$$A_{37} = -\frac{i(2A_0 + 6A_3 + 3A_5 + \sqrt{3}A_8)}{6}, A_{38} = \frac{i(2A_0 - 6A_3 + 3A_5 + \sqrt{3}A_8)}{6},$$

$$A_{39} = \frac{8A_0 - 6i\sqrt{3}A_3 + 3A_5 + \sqrt{3}A_8}{12}, A_{40} = \frac{-8A_0 - 6i\sqrt{3}A_3 - 3A_5 - \sqrt{3}A_8}{12}.$$

## 3. Four-dimensional matrixes

We define  $\Gamma_{i,j} = \sigma_i \otimes \sigma_j$  with  $i, j = 0, 1, 2, 3, \pm$  and

$$\begin{aligned}
\Gamma_1 &= \frac{\Gamma_{0,0} - i\sqrt{2}\Gamma_{0,2} - i\Gamma_{3,1} + \sqrt{3}(\sqrt{2}\Gamma_{1,0} + i\Gamma_{1,2} - \Gamma_{2,3})}{4}, \Gamma_2 = i\frac{\Gamma_{0,3} - \sqrt{2}\Gamma_{0,1} + \Gamma_{3,2} + \sqrt{3}(\Gamma_{1,1} + \sqrt{2}\Gamma_{1,3} - \Gamma_{2,0})}{4}, \\
\Gamma_3 &= \frac{\Gamma_{0,0} - i(\Gamma_{0,1} - \Gamma_{0,2} + \Gamma_{0,3})}{2}, \Gamma_4 = -\frac{\sqrt{3}\Gamma_{0,1} + \Gamma_{0,3} - i(\sqrt{3}\Gamma_{1,1} + \Gamma_{1,3})}{2\sqrt{2}}, \\
\Gamma_5 &= \frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2} + i\Gamma_{1,0} + \sqrt{3}\Gamma_{1,2} - i\Gamma_{2,0} - \sqrt{3}\Gamma_{2,2} - i\Gamma_{3,0} - \sqrt{3}\Gamma_{3,2}}{4}, \\
\Gamma_6 &= -\frac{i(\sqrt{6}\Gamma_{0,2} + 3\sqrt{2}\Gamma_{3,1} - 2\sqrt{3}\Gamma_{3,3})}{6}, \Gamma_7 = -\frac{i(\sqrt{6}\Gamma_{0,2} - 3\sqrt{2}\Gamma_{3,1} - 2\sqrt{3}\Gamma_{3,3})}{6}, \\
\Gamma_8 &= \frac{-\Gamma_{0,0} + 3\Gamma_{0,3} + i\sqrt{3}(\Gamma_{3,0} + \Gamma_{3,3})}{4}, \Gamma_9 = \frac{\Gamma_{0,2} - \Gamma_{3,1} - \Gamma_{3,3}}{i\sqrt{3}}, \Gamma_{10} = i\frac{(\sqrt{3} - 3)\Gamma_{0,2} - (3 + \sqrt{3})\Gamma_{3,1} + 2\sqrt{3}\Gamma_{3,3}}{6}, \\
\Gamma_{11} &= \frac{-\Gamma_{0,0} + i\Gamma_{0,2} - i\Gamma_{3,1} + i\Gamma_{3,3} + \sqrt{3}(\Gamma_{0,3} + i\Gamma_{3,0} - \Gamma_{0,1} + \Gamma_{3,2})}{4}, \Gamma_{12} = \frac{-\Gamma_{0,0} + i\sqrt{3}(\Gamma_{0,3} - i\sqrt{3}\Gamma_{3,0} + \Gamma_{3,3})}{4}, \\
\Gamma_{13} &= \frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2} - 3\Gamma_{3,0} + i\sqrt{3}\Gamma_{3,2}}{4}, \Gamma_{14} = \frac{\sqrt{3}\Gamma_{0,0} + 3i\Gamma_{0,3} + \sqrt{3}\Gamma_{3,0} - i\Gamma_{3,3}}{4}, \\
\Gamma_{15} &= \frac{-\sqrt{3}\Gamma_{0,0} + 3i\Gamma_{0,3} + \sqrt{3}\Gamma_{3,0} + i\Gamma_{3,3}}{4}, \Gamma_{16} = \frac{\sqrt{3}\Gamma_{0,0} + i(3\Gamma_{0,3} + i\sqrt{3}\Gamma_{3,0} + \Gamma_{3,3})}{4}, \\
\Gamma_{17} &= \frac{-i\Gamma_{0,0} + \sqrt{3}\Gamma_{0,3} - 3i\Gamma_{3,0} - \sqrt{3}\Gamma_{3,3}}{4}, \Gamma_{18} = \frac{-\Gamma_{0,0} - \Gamma_{0,3} + \Gamma_{3,0} - \Gamma_{3,3}}{2}, \Gamma_{19} = \frac{\Gamma_{0,1} - i\Gamma_{0,2} + \Gamma_{3,1} + i\Gamma_{3,2}}{2}, \\
\Gamma_{20} &= \frac{\Gamma_{0,0} - \Gamma_{0,3} - \Gamma_{3,0} - \Gamma_{3,3}}{2}, \Gamma_{21} = \frac{\Gamma_{0,2} + \Gamma_{0,3} - \Gamma_{3,2} + \Gamma_{3,3}}{2i}, \Gamma_{22} = \frac{\Gamma_{0,0} + \Gamma_{0,3} + \Gamma_{3,0} - \Gamma_{3,3}}{2}, \\
\Gamma_{23} &= \frac{-\Gamma_{0,0} + \Gamma_{0,1} + \Gamma_{3,0} + \Gamma_{3,1}}{2}, \Gamma_{24} = -\frac{i(\Gamma_{0,2} - \Gamma_{0,3} - \Gamma_{3,2} - \Gamma_{3,3})}{2}, \Gamma_{25} = \frac{-\Gamma_{0,0} + \Gamma_{0,3} - \Gamma_{3,0} - \Gamma_{3,3}}{2}, \\
\Gamma_{26} &= \frac{i\Gamma_{0,2} + \Gamma_{0,3} - i\Gamma_{3,2} + \Gamma_{3,3}}{2}, \Gamma_{27} = \frac{\Gamma_{0,0} + i(\Gamma_{0,1} - \Gamma_{0,2} - \Gamma_{0,3})}{2}, \Gamma_{28} = \frac{i(\Gamma_{0,1} - \Gamma_{0,2} + \Gamma_{0,3})}{\sqrt{3}}, \\
\Gamma_{29} &= \frac{(3 + \sqrt{3})\Gamma_{0,1} - (\sqrt{3} - 3)\Gamma_{0,2} - 2\sqrt{3}\Gamma_{0,3}}{6i}, \Gamma_{30} = -\frac{\Gamma_{0,1} + \Gamma_{0,2} + \Gamma_{0,3}}{\sqrt{3}}, \\
\Gamma_{31} &= \frac{-(\sqrt{3} - 3)\Gamma_{0,1} - (3 + \sqrt{3})\Gamma_{0,2} + 2\sqrt{3}\Gamma_{0,3}}{6}, \Gamma_{32} = -\frac{\Gamma_{0,2} + \Gamma_{3,1} + \Gamma_{3,3}}{\sqrt{3}}, \\
\Gamma_{33} &= \frac{-(3 + \sqrt{3})\Gamma_{0,2} - (\sqrt{3} - 3)\Gamma_{3,1} + 2\sqrt{3}\Gamma_{3,3}}{6}, \Gamma_{34} = -\frac{i(\sqrt{6}\Gamma_{0,2} - 3\sqrt{2}\Gamma_{3,1} + 2\sqrt{3}\Gamma_{3,3})}{6}, \\
\Gamma_{35} &= -\frac{i(\sqrt{6}\Gamma_{0,2} + 3\sqrt{2}\Gamma_{3,1} + 2\sqrt{3}\Gamma_{3,3})}{6}, \\
\Gamma_{36} &= \frac{2i\Gamma_{0,0} + 2\Gamma_{0,1} + 2\Gamma_{0,2} + 2\Gamma_{0,3} + \sqrt{6}[\Gamma_{1,0} - i(\Gamma_{1,1} + \Gamma_{1,2} + \Gamma_{1,3} - i\Gamma_{2,0} - \Gamma_{2,1} - \Gamma_{2,2} - \Gamma_{2,3})]}{8}, \\
\Gamma_{37} &= \frac{(3 + \sqrt{3})\Gamma_{0,2} - (\sqrt{3} - 3)\Gamma_{3,1} + 2\sqrt{3}\Gamma_{3,3}}{6}, \\
\Gamma_{38} &= \frac{(1 + i)[-i(\sqrt{3} - 3)\Gamma_{0,1} + 2i\sqrt{3}\Gamma_{0,3} + 6\Gamma_{3,0} + i(3 + \sqrt{3})\Gamma_{3,2}]}{12}.
\end{aligned}$$

#### 4. Six-dimensional matrixes

We define  $S_{i,j} = \sigma_i \otimes A_j$  with  $i = 0, 1, 2, 3$  and  $j = 0, 1, 2, 3, 4, 5, 7, 8$ , and

$$\begin{aligned}
S_1 &= \frac{2i(2S_{2,0} + \sqrt{3}S_{2,8}) + 3i(S_{0,2} - S_{0,3} - S_{1,2} - S_{1,3} + S_{2,6} - S_{2,7} + S_{3,2} + S_{3,3})}{12} \\
&\quad + \frac{S_{0,6} - S_{0,7} - 2S_{1,5} + S_{1,6} + S_{1,7} + S_{2,2} - S_{2,3} + S_{3,6} + S_{3,7}}{4}, \\
S_2 &= \frac{-S_{0,0} + \sqrt{3}S_{0,8} + 2S_{3,0} + \sqrt{3}S_{3,8}}{3}, S_3 = \frac{-2S_{0,0} - 3S_{0,5} - \sqrt{3}S_{0,8} + 3S_{3,5} - 3\sqrt{3}S_{3,8}}{6}, \\
S_4 &= \frac{-S_{0,5} - S_{0,7} - S_{1,6} - S_{2,2} - S_{3,5} + S_{3,7}}{2}, S_5 = \frac{S_{0,4} - S_{0,6} + S_{1,7} + S_{2,3} + S_{3,4} + S_{3,6}}{2}, \\
S_6 &= i \frac{S_{0,1} - S_{0,2} + S_{0,3} + i(S_{0,4} + S_{0,6} + S_{0,7})}{2}, S_7 = \frac{S_{0,0} - 3S_{0,5} - \sqrt{3}S_{0,8}}{3}, \\
S_8 &= S_{3,6} + \frac{-2S_{3,0} + 3S_{3,5} - \sqrt{3}S_{3,8}}{6}, \\
S_9 &= \frac{3[S_{0,5} - S_{3,5} + \sqrt{3}(S_{0,8} - S_{3,8}) - 2i(S_{0,2} + S_{3,2})] + 2i(2S_{2,0} - 3S_{2,5} + \sqrt{3}S_{2,8})}{12}, \\
S_{10} &= \frac{2(2S_{1,0} + \sqrt{3}S_{1,8}) + 3(S_{0,6} + S_{0,7} - S_{1,6} - S_{1,7} - S_{2,2} + S_{2,3} + S_{3,6} - S_{3,7})}{12} \\
&\quad + \frac{i(S_{0,2} + S_{0,3} + S_{1,2} + S_{1,3} - 2S_{2,5} - S_{2,6} + S_{2,7} + S_{3,2} - S_{3,3})}{4}, \\
S_{11} &= \frac{S_{0,0} + 3S_{0,5} - \sqrt{3}S_{0,8}}{3i}, S_{12} = -\frac{(-1)^{1/4}(2S_{3,0} + 6iS_{3,2} - 3S_{3,5} + \sqrt{3}S_{3,8})}{6}, \\
S_{13} &= \frac{-iS_{0,1} + iS_{0,2} + iS_{0,3} + S_{0,4} + S_{0,6} - S_{0,7}}{2}, S_{14} = \frac{i(-S_{3,0} + 3S_{3,4} + \sqrt{3}S_{3,8})}{3}, \\
S_{15} &= \frac{i(2S_{3,0} + 3S_{3,5} + 6S_{3,7} + \sqrt{3}S_{3,8})}{6}.
\end{aligned}$$

#### 5. Eight-dimensional matrixes

We define  $Q_{i,j,k} = \sigma_i \otimes \sigma_j \otimes \sigma_k$  with  $i, j, k = 0, 1, 2, 3$ , and

$$\begin{aligned}
Q_1 &= \frac{-Q_{0,0,0} - iQ_{0,0,2} + \sqrt{3}Q_{0,3,1} + \sqrt{3}Q_{0,3,3} + i[Q_{3,0,1} + Q_{3,0,3} + \sqrt{3}(Q_{3,3,0} + iQ_{3,3,2})]}{4}, \\
Q_2 &= \frac{Q_{0,0,0} - i\sqrt{2}Q_{0,0,2} + \sqrt{6}Q_{0,1,0} + i\sqrt{3}Q_{0,1,2} - \sqrt{3}Q_{0,2,3} - iQ_{0,3,1}}{4}.
\end{aligned}$$

## S7. ENCYCLOPEDIA OF EMERGENT PARTICLES IN 3D CRYSTALS WITHOUT SOC EFFECT

### A. The single-valued corepresentations of the 230 type-II MSGs and the essential degeneracies

#### 1. Notes to Sec. S7A

(i) For each table in Sec. S7A, the first two lines present the SG number, the BZ type, the generating elements of the type II MSG (translations are not included here), whether centrosymmetry is contained in the group and whether SOC is considered.

(ii) Below the first two lines, the columns from left to right (separated by the semicolons) are the high-symmetry momentum  $\mathbf{k}$ , the location of  $\mathbf{k}$  [with respect to reciprocal vectors  $(\mathbf{g}_1, \mathbf{g}_2, \mathbf{g}_3)$ ], the generating elements of the little group at  $\mathbf{k}$  (only point-group operators are presented and a full expression of each generating element can be found in Ref. [9] and in Sec. S5), the deduced corep of the little group at  $\mathbf{k}$ , the dimension of the corep, the matrix representations of the generating elements, the species and the topological charge of the essential degeneracy.

(iii) A correspondence between the notation of the corep used here ( $R_i$ ) and the band-representation notations can be found in Refs. [9, 10]. Moreover, Ref. [10] has established a SpaceGroupIrep package to analyze the band representation based on the notation of Ref. [9].

#### 2. SG 1-10

## SG 1

---

 $\Gamma_t; \{E|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 
 $\Gamma; (000); E, \mathcal{T}; R_1; 1; 1, 1;$ 
 $B; (\frac{1}{2}00); E, \mathcal{T}; R_1; 1; 1, 1;$ 
 $F; (0\frac{1}{2}0); E, \mathcal{T}; R_1; 1; 1, 1;$ 
 $G; (00\frac{1}{2}); E, \mathcal{T}; R_1; 1; 1, 1;$ 

## SG 2

---

 $\Gamma_t; \{I|000\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 
 $\Gamma; (000); I, \mathcal{T}; R_1; 1; 1, 1;$ 
 $R_2; 1; -1, 1;$ 
 $B; (\frac{1}{2}00); I, \mathcal{T}; R_1; 1; 1, 1;$ 
 $R_2; 1; -1, 1;$ 
 $F; (0\frac{1}{2}0); I, \mathcal{T}; R_1; 1; 1, 1;$ 
 $R_2; 1; -1, 1;$ 
 $G; (00\frac{1}{2}); I, \mathcal{T}; R_1; 1; 1, 1;$ 
 $R_2; 1; -1, 1;$

SG 3

 $\Gamma_m; \{C_{2z}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma;$	$(000);$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$B;$	$(\frac{\bar{1}}{2}00);$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$Y;$	$(0\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$Z;$	$(00\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$C;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$D;$	$(\frac{\bar{1}}{2}0\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$A;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$E;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$\Lambda;$	$\Gamma Z;$	$C_{2z};$	$R_1; 1; 1;$
			$R_2; 1; -1;$
$V;$	$BD;$	$C_{2z};$	$R_1; 1; 1;$
			$R_2; 1; -1;$
$W;$	$YC;$	$C_{2z};$	$R_1; 1; 1;$
			$R_2; 1; -1;$
$U;$	$AE;$	$C_{2z};$	$R_1; 1; 1;$
			$R_2; 1; -1;$



## SG 4

---

 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma$ ; (000);	$C_{2z}, \mathcal{T}; R_1;$	1; 1, 1;
	$R_2;$	1; -1, 1;
$B$ ; ( $\bar{1}\frac{1}{2}00$ );	$C_{2z}, \mathcal{T}; R_1;$	1; 1, 1;
	$R_2;$	1; -1, 1;
$Y$ ; ( $0\frac{1}{2}0$ );	$C_{2z}, \mathcal{T}; R_1;$	1; 1, 1;
	$R_2;$	1; -1, 1;
$Z$ ; ( $00\frac{1}{2}$ );	$C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-NS <sub>ZCDE</sub> ;
$C$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-NS <sub>ZCDE</sub> ;
$D$ ; ( $\bar{1}0\frac{1}{2}$ );	$C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-NS <sub>ZCDE</sub> ;
$A$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$C_{2z}, \mathcal{T}; R_1;$	1; 1, 1;
	$R_2;$	1; -1, 1;
$E$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-NS <sub>ZCDE</sub> ;
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}; R_1;$	1; 1;
	$R_2;$	1; -1;
$V$ ; BD;	$C_{2z}; R_1;$	1; 1;
	$R_2;$	1; -1;
$W$ ; YC;	$C_{2z}; R_1;$	1; 1;
	$R_2;$	1; -1;
$U$ ; AE;	$C_{2z}; R_1;$	1; 1;
	$R_2;$	1; -1;

## SG 5

---

 $\Gamma_m^b; \{C_{2z}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma$ ; (000);	$C_{2z}, \mathcal{T}; R_1;$	1; 1, 1;
	$R_2;$	1; -1, 1;
$A$ ; ( $\bar{1}\frac{1}{2}00$ );	$C_{2z}, \mathcal{T}; R_1;$	1; 1, 1;
	$R_2;$	1; -1, 1;
$Z$ ; ( $0\bar{1}\frac{1}{2}$ );	$C_{2z}, \mathcal{T}; R_1;$	1; 1, 1;
	$R_2;$	1; -1, 1;
$M$ ; ( $\bar{1}\bar{1}\frac{1}{2}$ );	$C_{2z}, \mathcal{T}; R_1;$	1; 1, 1;
	$R_2;$	1; -1, 1;
$L$ ; ( $\bar{1}0\frac{1}{2}$ );	$E, \mathcal{T}; R_1;$	1; 1, 1;
$V$ ; ( $00\frac{1}{2}$ );	$E, \mathcal{T}; R_1;$	1; 1, 1;
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}; R_1;$	1; 1;
	$R_2;$	1; -1;
$U$ ; AM;	$C_{2z}; R_1;$	1; 1;
	$R_2;$	1; -1;

## SG 6

---

 $\Gamma_m; \{\sigma_z|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma;$	$(000);$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$B;$	$(\bar{1}\bar{2}00);$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$Y;$	$(0\frac{1}{2}0);$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$Z;$	$(00\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$C;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$D;$	$(\bar{1}\bar{2}0\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$A;$	$(\frac{1}{2}\frac{1}{2}0);$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$E;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$\Lambda;$	$\Gamma Z;$	$E, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$
$V;$	$BD;$	$E, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$
$W;$	$YC;$	$E, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$
$U;$	$AE;$	$E, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$

## SG 7

---

 $\Gamma_m; \{\sigma_z|\frac{1}{2}00\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma;$	$(000);$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$B;$	$(\bar{1}\bar{2}00);$	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-WNLs;
$Y;$	$(0\frac{1}{2}0);$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$Z;$	$(00\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$C;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$D;$	$(\bar{1}\bar{2}0\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-WNLs;
$A;$	$(\frac{1}{2}\frac{1}{2}0);$	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-WNLs;
$E;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-WNLs;
$\Lambda;$	$\Gamma Z;$	$E, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$	
$V;$	$BD;$	$E, \mathcal{T}\sigma_z;$	$\{R_1, R_1\}; 2; \sigma_0, -i\sigma_2;$	WNL; $\pi$
$W;$	$YC;$	$E, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$	
$U;$	$AE;$	$E, \mathcal{T}\sigma_z;$	$\{R_1, R_1\}; 2; \sigma_0, -i\sigma_2;$	WNL; $\pi$

## SG 8

---

 $\Gamma_m^b; \{\sigma_z|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma;$	$(000);$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$A;$	$(\frac{1}{2}00);$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$Z;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$M;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$L;$	$(\frac{1}{2}0\frac{1}{2});$	$E, \mathcal{T};$	$R_1; 1; 1, 1;$
$V;$	$(00\frac{1}{2});$	$E, \mathcal{T};$	$R_1; 1; 1, 1;$
$\Lambda;$	$\Gamma Z;$	$E, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$
$U;$	AM;	$E, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$

## SG 9

---

 $\Gamma_m^b; \{\sigma_z|\frac{1}{2}00\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma;$	$(000);$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$A;$	$(\frac{1}{2}00);$	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-WNLs;
$Z;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$M;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-WNLs;
$L;$	$(\frac{1}{2}0\frac{1}{2});$	$E, \mathcal{T};$	$R_1; 1; 1, 1;$	
$V;$	$(00\frac{1}{2});$	$E, \mathcal{T};$	$R_1; 1; 1, 1;$	
$\Lambda;$	$\Gamma Z;$	$E, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$	
$U;$	AM;	$E, \mathcal{T}\sigma_z;$	$\{R_1, R_1\}; 2; \sigma_0, -i\sigma_2;$	WNL; $\pi$

SG 10

 $\Gamma_m; \{C_{2z}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$B; (\bar{1}00); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$Y; (0\frac{1}{2}0); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$Z; (00\frac{1}{2}); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$C; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$D; (\bar{1}0\frac{1}{2}); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$A; (\frac{1}{2}\frac{1}{2}0); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$E; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$\Lambda; \Gamma Z; C_{2z}, I\mathcal{T}; R_1; 1; 1, 1;$   
 $R_2; 1; -1, 1;$

$V; BD; C_{2z}, I\mathcal{T}; R_1; 1; 1, 1;$   
 $R_2; 1; -1, 1;$

$W; YC; C_{2z}, I\mathcal{T}; R_1; 1; 1, 1;$   
 $R_2; 1; -1, 1;$

$U; AE; C_{2z}, I\mathcal{T}; R_1; 1; 1, 1;$   
 $R_2; 1; -1, 1;$

## 3. SG 11-20

SG 11

 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC $\Gamma; (000); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $B; (\bar{1}00); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $Y; (0\frac{1}{2}0); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $Z; (00\frac{1}{2}); C_{2z}, I, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, -\sigma_0; \text{P-NS}_{ZCDE};$  $C; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, -\sigma_0; \text{P-NS}_{ZCDE};$  $D; (\bar{1}0\frac{1}{2}); C_{2z}, I, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, -\sigma_0; \text{P-NS}_{ZCDE};$  $A; (\frac{1}{2}\frac{1}{2}0); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $E; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, -\sigma_0; \text{P-NS}_{ZCDE};$  $\Lambda; \Gamma Z; C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1;$  $R_2; 1; -1, 1;$  $V; \text{BD}; C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1;$  $R_2; 1; -1, 1;$  $W; \text{YC}; C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1;$  $R_2; 1; -1, 1;$  $U; \text{AE}; C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1;$  $R_2; 1; -1, 1;$

SG 12

---

 $\Gamma_m^b; \{C_{2z}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$A; (\bar{1}00); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$Z; (0\bar{1}\frac{1}{2}); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$M; (\bar{1}\bar{2}\frac{1}{2}); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$L; (\bar{1}0\frac{1}{2}); I, \mathcal{T}; R_1; 1; 1, 1;$   
 $R_2; 1; -1, 1;$

$V; (00\frac{1}{2}); I, \mathcal{T}; R_1; 1; 1, 1;$   
 $R_2; 1; -1, 1;$

$\Lambda; \Gamma Z; C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1;$   
 $R_2; 1; -1, 1;$

$U; \text{AM}; C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1;$   
 $R_2; 1; -1, 1;$

SG 13

 $\Gamma_m; \{C_{2z}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; (000);	$C_{2z}, I, \mathcal{T}; R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$B$ ; ( $\frac{1}{2}00$ );	$\sigma_z, I, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ; P-WNLs;		
$Y$ ; ( $0\frac{1}{2}0$ );	$C_{2z}, I, \mathcal{T}; R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$Z$ ; ( $00\frac{1}{2}$ );	$C_{2z}, I, \mathcal{T}; R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$C$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, I, \mathcal{T}; R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$D$ ; ( $\frac{1}{2}0\frac{1}{2}$ );	$\sigma_z, I, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ; P-WNLs;		
$A$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$\sigma_z, I, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ; P-WNLs;		
$E$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, I, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ; P-WNLs;		
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}, I, \mathcal{T}; R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$V$ ; BD;	$C_{2z}, I, \mathcal{T}; \{R_1, R_2\};$	2; $\sigma_3, \sigma_1$ ;	WNL;	$\pi$
$W$ ; YC;	$C_{2z}, I, \mathcal{T}; R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U$ ; AE;	$C_{2z}, I, \mathcal{T}; \{R_1, R_2\};$	2; $\sigma_3, \sigma_1$ ;	WNL;	$\pi$

SG 14

 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \{I|\frac{1}{2}0\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_{2z}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
			$R_2;$	$1; 1, -1, 1;$		
			$R_3;$	$1; -1, 1, 1;$		
			$R_4;$	$1; -1, -1, 1;$		
$B;$	$(\frac{1}{2}00);$	$\sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$Y;$	$(0\frac{1}{2}0);$	$C_{2z}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
			$R_2;$	$1; 1, -1, 1;$		
			$R_3;$	$1; -1, 1, 1;$		
			$R_4;$	$1; -1, -1, 1;$		
$Z;$	$(00\frac{1}{2});$	$C_{2z}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ZCDE</sub> ;	
$C;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{2z}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ZCDE</sub> ;	
$D;$	$(\frac{1}{2}0\frac{1}{2});$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, \sigma_1;$	P-WNL/NS;	
			$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, \sigma_1;$	P-WNL/NS;	
$A;$	$(\frac{1}{2}\frac{1}{2}0);$	$\sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$E;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, \sigma_1;$	P-WNL/NS;	
			$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, \sigma_1;$	P-WNL/NS;	
$\Lambda;$	$\Gamma Z;$	$C_{2z}, I\mathcal{T};$	$R_1;$	$1; 1, 1;$		
			$R_2;$	$1; -1, 1;$		
$V;$	BD;	$C_{2z}, I\mathcal{T};$	$\{R_1, R_2\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$W;$	YC;	$C_{2z}, I\mathcal{T};$	$R_1;$	$1; 1, 1;$		
			$R_2;$	$1; -1, 1;$		
$U;$	AE;	$C_{2z}, I\mathcal{T};$	$\{R_1, R_2\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$



SG 15

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 $\Gamma_m^b; \{C_{2z}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_{2z}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$	
			$R_2;$	$1; 1, -1, 1;$	
			$R_3;$	$1; -1, 1, 1;$	
			$R_4;$	$1; -1, -1, 1;$	
$A;$	$(\frac{1}{2}00);$	$\sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;
$Z;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{2z}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$	
			$R_2;$	$1; 1, -1, 1;$	
			$R_3;$	$1; -1, 1, 1;$	
			$R_4;$	$1; -1, -1, 1;$	
$M;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;
$L;$	$(\frac{1}{2}0\frac{1}{2});$	$I, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$R_2;$	$1; -1, 1;$	
$V;$	$(00\frac{1}{2});$	$I, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$R_2;$	$1; -1, 1;$	
$\Lambda;$	$\Gamma Z;$	$C_{2z}, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$R_2;$	$1; -1, 1;$	
$U;$	AM;	$C_{2z}, I\mathcal{T};$	$\{R_1, R_2\};$	$2; \sigma_3, \sigma_1;$	WNL; $\pi$

SG 16

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC $\Gamma; (000); C_{2z}, C_{2y}, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $Y; (\bar{1}00); C_{2z}, C_{2y}, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $X; (0\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $Z; (00\frac{1}{2}); C_{2z}, C_{2y}, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $U; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $T; (\bar{1}0\frac{1}{2}); C_{2z}, C_{2y}, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $S; (\bar{1}\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $R; (\bar{1}\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, \mathcal{T}; R_1; 1; 1, 1, 1;$  $R_2; 1; 1, -1, 1;$  $R_3; 1; -1, 1, 1;$  $R_4; 1; -1, -1, 1;$  $\Delta; \Gamma Y; C_{2y}, \mathcal{T} C_{2x}; R_1; 1; 1, 1;$  $R_2; 1; -1, 1;$  $D; X S; C_{2y}, \mathcal{T} C_{2x}; R_1; 1; 1, 1;$  $R_2; 1; -1, 1;$  $P; U R; C_{2y}, \mathcal{T} C_{2x}; R_1; 1; 1, 1;$  $R_2; 1; -1, 1;$  $B; Z T; C_{2y}, \mathcal{T} C_{2x}; R_1; 1; 1, 1;$  $R_2; 1; -1, 1;$  $\Sigma; \Gamma X; C_{2x}, \mathcal{T} C_{2z}; R_1; 1; 1, 1;$  $R_2; 1; -1, 1;$

$$\begin{aligned}
C; \text{ YS}; \ C_{2x}, \mathcal{T}C_{2z}; \ R_1; \ 1; \ 1, 1; \\
\qquad \qquad \qquad R_2; \ 1; \ -1, 1; \\
E; \text{ TR}; \ C_{2x}, \mathcal{T}C_{2z}; \ R_1; \ 1; \ 1, 1; \\
\qquad \qquad \qquad R_2; \ 1; \ -1, 1; \\
A; \text{ ZU}; \ C_{2x}, \mathcal{T}C_{2z}; \ R_1; \ 1; \ 1, 1; \\
\qquad \qquad \qquad R_2; \ 1; \ -1, 1; \\
\Lambda; \text{ \Gamma Z}; \ C_{2z}, \mathcal{T}C_{2x}; \ R_1; \ 1; \ 1, 1; \\
\qquad \qquad \qquad R_2; \ 1; \ -1, 1; \\
H; \text{ YT}; \ C_{2z}, \mathcal{T}C_{2x}; \ R_1; \ 1; \ 1, 1; \\
\qquad \qquad \qquad R_2; \ 1; \ -1, 1; \\
Q; \text{ SR}; \ C_{2z}, \mathcal{T}C_{2x}; \ R_1; \ 1; \ 1, 1; \\
\qquad \qquad \qquad R_2; \ 1; \ -1, 1; \\
G; \text{ XU}; \ C_{2z}, \mathcal{T}C_{2x}; \ R_1; \ 1; \ 1, 1; \\
\qquad \qquad \qquad R_2; \ 1; \ -1, 1;
\end{aligned}$$

SG 17

 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000);$	$C_{2z}, C_{2y}, \mathcal{T}; R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$Y; (\bar{1}200);$	$C_{2z}, C_{2y}, \mathcal{T}; R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$X; (0\frac{1}{2}0);$	$C_{2z}, C_{2y}, \mathcal{T}; R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;
$T; (\bar{1}20\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;
$S; (\bar{1}2\frac{1}{2}0);$	$C_{2z}, C_{2y}, \mathcal{T}; R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$R; (\bar{1}2\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;
$\Delta; \Gamma Y;$	$C_{2y}, \mathcal{T}C_{2x}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$D; X S;$	$C_{2y}, \mathcal{T}C_{2x}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$P; U R;$	$C_{2y}, \mathcal{T}C_{2x}; \{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;
$B; Z T;$	$C_{2y}, \mathcal{T}C_{2x}; \{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;
$\Sigma; \Gamma X;$	$C_{2x}, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$C; Y S;$	$C_{2x}, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$E; T R;$	$C_{2x}, \mathcal{T}C_{2z}; \{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;
$A; Z U;$	$C_{2x}, \mathcal{T}C_{2z}; \{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;
$\Lambda; \Gamma Z;$	$C_{2z}, \mathcal{T}C_{2x}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$H; Y T;$	$C_{2z}, \mathcal{T}C_{2x}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$Q; S R;$	$C_{2z}, \mathcal{T}C_{2x}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$G; X U;$	$C_{2z}, \mathcal{T}C_{2x}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	

SG 18

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, \mathcal{T}; R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$Y; (\frac{1}{2}00);$	$C_{2y}, C_{2z}, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
$X; (0\frac{1}{2}0);$	$C_{2x}, C_{2z}, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T}; R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2x}, C_{2z}, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
$T; (\frac{1}{2}0\frac{1}{2});$	$C_{2y}, C_{2z}, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
$S; (\frac{1}{2}\frac{1}{2}0);$	$C_{2y}, C_{2z}, \mathcal{T}; \{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NSs;
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2y}, C_{2z}, \mathcal{T}; \{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NSs;
$\Delta; \Gamma Y;$	$C_{2y}, \mathcal{T}C_{2x}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$D; XS;$	$C_{2y}, \mathcal{T}C_{2x}; \{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>XUSR</sub> ;
$P; UR;$	$C_{2y}, \mathcal{T}C_{2x}; \{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>XUSR</sub> ;
$B; ZT;$	$C_{2y}, \mathcal{T}C_{2x}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$\Sigma; \Gamma X;$	$C_{2x}, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$C; YS;$	$C_{2x}, \mathcal{T}C_{2z}; \{R_2, R_4\};$	2; $-\sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
$E; TR;$	$C_{2x}, \mathcal{T}C_{2z}; \{R_2, R_4\};$	2; $-\sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
$A; ZU;$	$C_{2x}, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$\Lambda; \Gamma Z;$	$C_{2z}, \mathcal{T}C_{2x}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$H; YT;$	$C_{2z}, \mathcal{T}C_{2x}; \{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
$Q; SR;$	$C_{2z}, \mathcal{T}C_{2x}; \{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	L-NSs;
	$\{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	L-NSs;
$G; XU;$	$C_{2z}, \mathcal{T}C_{2x}; \{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>XUSR</sub> ;

SG 19

 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$	
		$R_2;$	$1; 1, -1, 1;$	
		$R_3;$	$1; -1, 1, 1;$	
		$R_4;$	$1; -1, -1, 1;$	
$Y; (\bar{1}00);$	$C_{2y}, C_{2z}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
$X; (0\frac{1}{2}0);$	$C_{2x}, C_{2z}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2x}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, \sigma_1;$	P-NSs;
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, \sigma_1;$	P-NSs;
$T; (\bar{1}0\frac{1}{2});$	$C_{2z}, C_{2x}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, \sigma_1;$	P-NSs;
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, \sigma_1;$	P-NSs;
$S; (\bar{1}\frac{1}{2}0);$	$C_{2x}, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, \sigma_1;$	P-NSs;
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, \sigma_1;$	P-NSs;
$R; (\bar{1}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$\{R_5, R_5\};$	$4; i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,2};$	C-2 DP; 2
$\Delta; \Gamma Y;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1;$	$1; 1, 1;$	
		$R_2;$	$1; -1, 1;$	
$D; XS;$	$C_{2y}, \mathcal{T}C_{2x};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	L-NS <sub>XUSR</sub> ;
$P; UR;$	$C_{2y}, \mathcal{T}C_{2x};$	$\{R_2, R_2\};$	$2; \sigma_0, -i\sigma_2;$	L-NSs;
		$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$	L-NSs;
$B; ZT;$	$C_{2y}, \mathcal{T}C_{2x};$	$\{R_1, R_2\};$	$2; \sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;
$\Sigma; \Gamma X;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	
		$R_2;$	$1; -1, 1;$	
$C; YS;$	$C_{2x}, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	$2; \sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
$E; TR;$	$C_{2x}, \mathcal{T}C_{2z};$	$\{R_2, R_2\};$	$2; \sigma_0, -i\sigma_2;$	L-NSs;
		$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$	L-NSs;
$A; ZU;$	$C_{2x}, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;
$\Lambda; \Gamma Z;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_1;$	$1; 1, 1;$	
		$R_2;$	$1; -1, 1;$	
$H; YT;$	$C_{2z}, \mathcal{T}C_{2x};$	$\{R_2, R_4\};$	$2; -\sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
$Q; SR;$	$C_{2z}, \mathcal{T}C_{2x};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	L-NSs;
		$\{R_4, R_4\};$	$2; \sigma_0, -i\sigma_2;$	L-NSs;
$G; XU;$	$C_{2z}, \mathcal{T}C_{2x};$	$\{R_1, R_2\};$	$2; \sigma_3, -i\sigma_2;$	L-NS <sub>XUSR</sub> ;

SG 20

 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_{2z}, C_{2y}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$Z; (00\frac{1}{2}); C_{2z}, C_{2x}, \mathcal{T}; R_5;$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ; P-NS <sub>ZTR</sub> ;	
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2x}, \mathcal{T}; R_5;$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ; P-NS <sub>ZTR</sub> ;	
$S; (0\frac{1}{2}0); C_{2z}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, \mathcal{T}; \{R_2, R_4\};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1$ ; P-NS <sub>ZTR</sub> ;	
$\Lambda; \Gamma Z; C_{2z}, \mathcal{T}C_{2x}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$H; Y\Gamma; C_{2z}, \mathcal{T}C_{2x}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$D; S\Gamma; C_{2z}; R_1;$	$R_1;$	1; 1;	
	$R_2;$	1; -1;	
$A; Z\Gamma; C_{2x}, \mathcal{T}C_{2z}; \{R_1, R_2\};$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2$ ; L-NS <sub>ZTR</sub> ;	
$\Sigma; \Gamma Y; C_{2x}, \mathcal{T}C_{2z}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$\Delta; \Gamma\Delta; C_{2y}, \mathcal{T}C_{2x}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$B; ZB; C_{2y}, \mathcal{T}C_{2x}; \{R_2, R_4\};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1$ ; L-NS <sub>ZTR</sub> ;	
$G; T\Gamma; C_{2y}, \mathcal{T}C_{2x}; \{R_2, R_4\};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1$ ; L-NS <sub>ZTR</sub> ;	
$F; Y\Gamma; C_{2y}, \mathcal{T}C_{2x}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$E; T\Gamma; C_{2x}, \mathcal{T}C_{2z}; \{R_1, R_2\};$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2$ ; L-NS <sub>ZTR</sub> ;	
$C; Y\Gamma; C_{2x}, \mathcal{T}C_{2z}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	

## 4. SG 21-30

SG 21

 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$S; (0\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$\Lambda; \Gamma Z;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$H; Y\Gamma;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$D; \text{SR};$	$C_{2z};$	$R_1; 1; 1;$
		$R_2; 1; -1;$
$A; Z\Gamma;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$\Sigma; \Gamma Y;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$\Delta; \Gamma \Delta;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$B; ZB;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$G; \text{TG};$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$F; YF;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$E; \text{TE};$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$C; YC;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$



SG 22

 $\Gamma_o^f; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$Y; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$X; (\frac{1}{2}0\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$Z; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$L; (\frac{1}{2}00);$	$E, \mathcal{T};$	$R_1; 1; 1, 1;$
$\Lambda; \Gamma Z/\Gamma \Lambda;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$G; XG/XY;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$H; YH/YX;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$Q; ZQ;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$\Sigma; \Gamma X/\Gamma \Sigma;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$C; YC/YZ;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$A; ZA/ZY;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$U; XU;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$\Delta; \Gamma Y/\Gamma \Delta;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$D; XD/XZ;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$B; ZB/ZX;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$R; YR;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$

SG 23

 $\Gamma_o^v; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$ (000);	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$X;$ $(\frac{1}{2}\frac{\bar{1}}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$R;$ $(\frac{1}{2}00);$	$C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$S;$ $(\frac{1}{2}0\frac{\bar{1}}{2});$	$C_{2x}, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$T;$ $(\frac{1}{2}\frac{\bar{1}}{2}0);$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$W;$ $(\frac{3}{4}\frac{\bar{1}}{4}\frac{\bar{1}}{4});$	$C_{2z}, C_{2y};$	$R_1; 1; 1, 1;$
		$R_2; 1; 1, -1;$
		$R_3; 1; -1, 1;$
		$R_4; 1; -1, -1;$
$\Lambda;$ $\Gamma\Lambda/\Gamma X;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$G;$ $XG;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$P;$ $TW;$	$C_{2z};$	$R_1; 1; 1;$
		$R_2; 1; -1;$
$\Sigma;$ $\Gamma\Sigma/\Gamma X;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$F;$ $XF;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$D;$ $SW;$	$C_{2x};$	$R_1; 1; 1;$
		$R_2; 1; -1;$
$\Delta;$ $\Gamma\Delta/\Gamma X;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$U;$ $XU;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$Q;$ $RW;$	$C_{2y};$	$R_1; 1; 1;$
		$R_2; 1; -1;$

SG 24

 $\Gamma_o^v; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$ (000);	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$X;$ ( $\frac{1}{2}\bar{1}\frac{1}{2}$ );	$C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$R;$ ( $\frac{1}{2}00$ );	$C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$S;$ ( $\frac{1}{2}0\bar{1}\frac{1}{2}$ );	$C_{2x}, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$T;$ ( $\frac{1}{2}\bar{1}0$ );	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$W;$ ( $\frac{3}{4}\bar{1}\frac{1}{4}$ );	$E, C_{2z}, C_{2y};$	$R_9; 2; i\sigma_0, \sigma_1, \sigma_3; \text{C-1 WP}; 1$
$\Lambda;$ $\Gamma\Lambda/\Gamma X;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$G;$ $XG;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_1; 1; -1, 1;$
		$R_2; 1; 1, 1;$
$P;$ $TW;$	$C_{2z};$	$R_2; 1; 1;$
		$R_4; 1; -1;$
$\Sigma;$ $\Gamma\Sigma/\Gamma X;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$F;$ $XF;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_1; 1; -1, 1;$
		$R_2; 1; 1, 1;$
$D;$ $SW;$	$C_{2x};$	$R_2; 1; -1;$
		$R_4; 1; 1;$
$\Delta;$ $\Gamma\Delta/\Gamma X;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$U;$ $XU;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$Q;$ $RW;$	$C_{2y};$	$R_2; 1; 1;$
		$R_4; 1; -1;$

SG 25

 $\Gamma_o; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$Y; (\bar{1}00); C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$X; (0\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$Z; (00\frac{1}{2}); C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$U; (0\frac{1}{2}\frac{1}{2}); C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$T; (\bar{1}0\frac{1}{2}); C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$S; (\bar{1}\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$R; (\bar{1}\frac{1}{2}\frac{1}{2}); C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$\Delta; \Gamma Y; \sigma_x, \mathcal{T} C_{2z};$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$D; X S; \sigma_x, \mathcal{T} C_{2z};$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$P; U R; \sigma_x, \mathcal{T} C_{2z};$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$B; Z T; \sigma_x, \mathcal{T} C_{2z};$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$\Sigma; \Gamma X; \sigma_y, \mathcal{T} \sigma_x;$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$C; Y S; \sigma_y, \mathcal{T} \sigma_x;$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$E; T R; \sigma_y, \mathcal{T} \sigma_x;$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$

$A$ ; ZU;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \sigma_y$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; 1, -1;  
 $R_3$ ; 1; -1, 1;  
 $R_4$ ; 1; -1, -1;  
 $H$ ; YT;  $C_{2z}, \sigma_y$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; 1, -1;  
 $R_3$ ; 1; -1, 1;  
 $R_4$ ; 1; -1, -1;  
 $Q$ ; SR;  $C_{2z}, \sigma_y$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; 1, -1;  
 $R_3$ ; 1; -1, 1;  
 $R_4$ ; 1; -1, -1;  
 $G$ ; XU;  $C_{2z}, \sigma_y$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; 1, -1;  
 $R_3$ ; 1; -1, 1;  
 $R_4$ ; 1; -1, -1;

SG 26

 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$Y; (\bar{1}00); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$X; (0\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$Z; (00\frac{1}{2}); C_{2z}, \sigma_x, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
	$\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
$U; (0\frac{1}{2}\frac{1}{2}); C_{2z}, \sigma_x, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
	$\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
$T; (\bar{1}0\frac{1}{2}); C_{2z}, \sigma_x, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
	$\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
$S; (\bar{1}\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$R; (\bar{1}\frac{1}{2}\frac{1}{2}); C_{2z}, \sigma_x, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
	$\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
$\Delta; \Gamma Y; \sigma_x, \mathcal{T} C_{2z}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$D; X S; \sigma_x, \mathcal{T} C_{2z}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$P; U R; \sigma_x, \mathcal{T} C_{2z}; \{R_1, R_1\}; 2; \sigma_0, -i\sigma_2;$	$\{R_1, R_1\}; 2; \sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
	$\{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
$B; Z T; \sigma_x, \mathcal{T} C_{2z}; \{R_1, R_1\}; 2; \sigma_0, -i\sigma_2;$	$\{R_1, R_1\}; 2; \sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
	$\{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
$\Sigma; \Gamma X; \sigma_y, \mathcal{T} \sigma_x; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$C; Y S; \sigma_y, \mathcal{T} \sigma_x; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$E; T R; \sigma_y, \mathcal{T} \sigma_x; \{R_1, R_2\}; 2; -i\sigma_3, \sigma_1;$	$\{R_1, R_2\}; 2; -i\sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
$A; Z U; \sigma_y, \mathcal{T} \sigma_x; \{R_1, R_2\}; 2; -i\sigma_3, \sigma_1;$	$\{R_1, R_2\}; 2; -i\sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
$\Lambda; \Gamma Z; C_{2z}, \sigma_y; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; 1, -1;	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; -1, -1;	
$H; Y T; C_{2z}, \sigma_y; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; 1, -1;	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; -1, -1;	

$Q; \text{SR}; C_{2z, \sigma_y}; R_1; 1; 1, 1;$   
 $R_2; 1; 1, -1;$   
 $R_3; 1; -1, 1;$   
 $R_4; 1; -1, -1;$   
 $G; \text{XU}; C_{2z, \sigma_y}; R_1; 1; 1, 1;$   
 $R_2; 1; 1, -1;$   
 $R_3; 1; -1, 1;$   
 $R_4; 1; -1, -1;$

SG 27

 $\Gamma_o; \{C_{2z}|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$Y; (\bar{1}00); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$X; (0\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$Z; (00\frac{1}{2}); \sigma_y, C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$			P-WNLs;	
	$\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, \sigma_1;$		P-WNLs;	
$U; (0\frac{1}{2}\frac{1}{2}); \sigma_y, C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$			P-WNLs;	
	$\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, \sigma_1;$		P-WNLs;	
$T; (\bar{1}0\frac{1}{2}); \sigma_y, C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$			P-WNLs;	
	$\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, \sigma_1;$		P-WNLs;	
$S; (\bar{1}\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$R; (\bar{1}\frac{1}{2}\frac{1}{2}); \sigma_y, C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1;$			P-WNLs;	
	$\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, \sigma_1;$		P-WNLs;	
$\Delta; \Gamma Y; \sigma_x, \mathcal{T}C_{2z}; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$D; X S; \sigma_x, \mathcal{T}C_{2z}; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$P; UR; \sigma_x, \mathcal{T}C_{2z}; \{R_1, R_2\}; 2; -i\sigma_3, \sigma_1;$			WNL;	$\pi$
$B; ZT; \sigma_x, \mathcal{T}C_{2z}; \{R_1, R_2\}; 2; -i\sigma_3, \sigma_1;$			WNL;	$\pi$
$\Sigma; \Gamma X; \sigma_y, \mathcal{T}\sigma_x; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$C; Y S; \sigma_y, \mathcal{T}\sigma_x; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$E; TR; \sigma_y, \mathcal{T}\sigma_x; \{R_1, R_2\}; 2; -i\sigma_3, -i\sigma_2;$			WNL;	$\pi$
$A; ZU; \sigma_y, \mathcal{T}\sigma_x; \{R_1, R_2\}; 2; -i\sigma_3, -i\sigma_2;$			WNL;	$\pi$
$\Lambda; \Gamma Z; C_{2z}, \sigma_y; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$H; YT; C_{2z}, \sigma_y; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		



$$\begin{aligned} Q; \text{SR}; C_{2z, \sigma_y}; R_1; 1; 1, 1; \\ R_2; 1; 1, -1; \\ R_3; 1; -1, 1; \\ R_4; 1; -1, -1; \\ G; \text{XU}; C_{2z, \sigma_y}; R_1; 1; 1, 1; \\ R_2; 1; 1, -1; \\ R_3; 1; -1, 1; \\ R_4; 1; -1, -1; \end{aligned}$$

SG 28

 $\Gamma_o; \{C_{2z}|\frac{1}{2}00\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$Y; (\frac{1}{2}00);$	$\sigma_x, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$T; (\frac{1}{2}0\frac{1}{2});$	$\sigma_x, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$S; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_x, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_x, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$D; X S;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$P; U R;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$B; Z T;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$C; Y S;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; T R;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$A; Z U;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
$H; Y T;$	$C_{2z}, \sigma_y;$	$R_5;$	2; $-\sigma_2, \sigma_3;$	WNL;	$\pi$
$Q; S R;$	$C_{2z}, \sigma_y;$	$R_5;$	2; $-\sigma_2, \sigma_3;$	WNL;	$\pi$
$G; X U;$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		

$\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T}; R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$Y; (\frac{1}{2}00);$	$\sigma_x, C_{2z}, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;
$X; (0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T}; R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T}; \{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T}; \{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;
$T; (\frac{1}{2}0\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T}; \{R_5, R_5\};$	4; $i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,2};$	DP; 0
$S; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_x, C_{2z}, \mathcal{T}; R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T}; \{R_5, R_5\};$	4; $i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,2};$	DP; 0
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$D; X S;$	$\sigma_x, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$P; U R;$	$\sigma_x, \mathcal{T}C_{2z}; \{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;
	$\{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;
$B; Z T;$	$\sigma_x, \mathcal{T}C_{2z}; \{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;
	$\{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x; R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$C; Y S;$	$\sigma_y, \mathcal{T}\sigma_x; \{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	WNL; $\pi$
$E; T R;$	$\sigma_y, \mathcal{T}\sigma_x; \{R_1, R_1\};$	2; $-i\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;
	$\{R_2, R_2\};$	2; $i\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;
$A; Z U;$	$\sigma_y, \mathcal{T}\sigma_x; \{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y; R_1;$	1; 1, 1;	
	$R_2;$	1; 1, -1;	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; -1, -1;	
$H; Y T;$	$C_{2z}, \sigma_y; R_5;$	2; $-\sigma_2, \sigma_3;$	WNL; $\pi$
$Q; S R;$	$C_{2z}, \sigma_y; R_5;$	2; $-\sigma_2, \sigma_3;$	WNL; $\pi$
$G; X U;$	$C_{2z}, \sigma_y; R_1;$	1; 1, 1;	
	$R_2;$	1; 1, -1;	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; -1, -1;	

SG 30

 $\Gamma_o; \{C_{2z}|\frac{1}{2}00\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$Y; (\frac{1}{2}00);$	$\sigma_x, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$Z; (00\frac{1}{2});$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$T; (\frac{1}{2}0\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$S; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_x, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$D; \text{XS};$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$P; \text{UR};$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	WNL;	$\pi$
$B; \text{ZT};$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$C; \text{YS};$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; \text{TR};$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; $-i, 1;$		
		$R_2;$	1; $i, 1;$		
$A; \text{ZU};$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
$H; \text{YT};$	$C_{2z}, \sigma_y;$	$R_5;$	2; $-\sigma_2, \sigma_3;$	WNL;	$\pi$
$Q; \text{SR};$	$C_{2z}, \sigma_y;$	$R_5;$	2; $-\sigma_2, \sigma_3;$	WNL;	$\pi$
$G; \text{XU};$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		

## 5. SG 31-40

SG 31

 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$Y; (\bar{1}\frac{1}{2}00);$	$\sigma_x, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
$T; (\bar{1}\frac{1}{2}0\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNL/NS;	
$S; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_x, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNL/NS;	
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$D; XS;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$P; UR;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
$B; ZT;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$C; YS;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; TR;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
$A; ZU;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
		$\{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
$H; YT;$	$C_{2z}, \sigma_y;$	$R_5;$	2; $-\sigma_2, \sigma_3;$	WNL;	$\pi$
$Q; SR;$	$C_{2z}, \sigma_y;$	$R_5;$	2; $-\sigma_2, \sigma_3;$	WNL;	$\pi$
$G; XU;$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		

SG 32

 $\Gamma_o; \{C_{2z}|\frac{1}{2}\frac{1}{2}0\}, \{\sigma_y|0\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$Y; (\frac{1}{2}00);$	$\sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0);$	$\sigma_y, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$T; (\frac{1}{2}0\frac{1}{2});$	$\sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$S; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$D; XS;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$P; UR;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$B; ZT;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$C; YS;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; TR;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$A; ZU;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
$H; YT;$	$C_{2z}, \sigma_y;$	$R_5;$	2; $-\sigma_2, \sigma_3;$	WNL;	$\pi$
$Q; SR;$	$C_{2z}, \sigma_y, E;$	$R_5;$	1; 1, -i, 1;		
		$R_6;$	1; -1, -i, 1;		
		$R_7;$	1; 1, i, 1;		
		$R_8;$	1; -1, i, 1;		
$G; XU;$	$C_{2z}, \sigma_y;$	$R_5;$	2; $\sigma_2, -i\sigma_3;$	WNL;	$\pi$

SG 33

 $\Gamma_o; \{C_{2z}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_y|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$Y; (\frac{1}{2}00);$	$\sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0);$	$\sigma_y, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub>	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub>	
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNL/NS;	
$T; (\frac{1}{2}0\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$\{R_5, R_5\};$	4; $i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,2};$	DP;	0
$S; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub>	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZUTR</sub>	
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$D; X S;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$P; U R;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
$B; Z T;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
		$\{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$C; Y S;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; T R;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_1\};$	2; $-i\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
		$\{R_2, R_2\};$	2; $i\sigma_0, -i\sigma_2;$	L-NS <sub>ZUTR</sub> ;	
$A; Z U;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
$H; Y T;$	$C_{2z}, \sigma_y;$	$R_5;$	2; $-\sigma_2, \sigma_3;$	WNL;	$\pi$
$Q; S R;$	$C_{2z}, \sigma_y, E;$	$R_5;$	1; 1, -i, 1;		
		$R_6;$	1; -1, -i, 1;		
		$R_7;$	1; 1, i, 1;		
		$R_8;$	1; -1, i, 1;		
$G; X U;$	$C_{2z}, \sigma_y;$	$R_5;$	2; $\sigma_2, -i\sigma_3;$	WNL;	$\pi$

SG 34

 $\Gamma_o; \{C_{2z}|\frac{1}{2}\frac{1}{2}0\}, \{\sigma_y|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$Y; (\bar{1}00);$	$\sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0);$	$\sigma_y, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$T; (\bar{1}0\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$S; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$R; (\bar{1}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$D; XS;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$P; UR;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; $-i, 1;$		
		$R_2;$	1; $i, 1;$		
$B; ZT;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$C; YS;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; TR;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; $-i, 1;$		
		$R_2;$	1; $i, 1;$		
$A; ZU;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
$H; YT;$	$C_{2z}, \sigma_y;$	$R_5;$	2; $-\sigma_2, \sigma_3;$	WNL;	$\pi$
$Q; SR;$	$C_{2z}, \sigma_y, E;$	$R_5;$	1; 1, $-i, 1;$		
		$R_6;$	1; -1, $-i, 1;$		
		$R_7;$	1; 1, $i, 1;$		
		$R_8;$	1; -1, $i, 1;$		
$G; XU;$	$C_{2z}, \sigma_y;$	$R_5;$	2; $\sigma_2, -i\sigma_3;$	WNL;	$\pi$



SG 35

 $\Gamma_o^b; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$S; (0\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_1; 1; 1, 1;$
		$R_2; 1; 1, -1;$
		$R_3; 1; -1, 1;$
		$R_4; 1; -1, -1;$
$H; Y T;$	$C_{2z}, \sigma_y;$	$R_1; 1; 1, 1;$
		$R_2; 1; 1, -1;$
		$R_3; 1; -1, 1;$
		$R_4; 1; -1, -1;$
$D; S R;$	$C_{2z};$	$R_1; 1; 1;$
		$R_2; 1; -1;$
$A; Z T;$	$\sigma_y, \mathcal{T} \sigma_x;$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$\Sigma; \Gamma Y;$	$\sigma_y, \mathcal{T} \sigma_x;$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$\Delta; \Gamma \Delta;$	$\sigma_x, \mathcal{T} C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$B; Z B;$	$\sigma_x, \mathcal{T} C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$G; T G;$	$\sigma_x, \mathcal{T} C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$F; Y F;$	$\sigma_x, \mathcal{T} C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$E; T E;$	$\sigma_y, \mathcal{T} \sigma_x;$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$C; Y C;$	$\sigma_y, \mathcal{T} \sigma_x;$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$

SG 36

 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$Z; (00\frac{1}{2}); C_{2z}, \sigma_y, \mathcal{T}; \{R_2, R_4\};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZTR</sub> ;
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZTR</sub> ;
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2z}, \sigma_y, \mathcal{T}; \{R_2, R_4\};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NS <sub>ZTR</sub> ;
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>ZTR</sub> ;
$S; (0\frac{1}{2}0); C_{2z}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, \mathcal{T}; \{R_2, R_4\};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	P-NS <sub>ZTR</sub> ;
$\Lambda; \Gamma Z; C_{2z}, \sigma_y; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; 1, -1;	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; -1, -1;	
$H; YT; C_{2z}, \sigma_y; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; 1, -1;	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; -1, -1;	
$D; SR; C_{2z}; R_1;$	$R_1;$	1; 1;	
	$R_2;$	1; -1;	
$A; ZT; \sigma_y, \mathcal{T}\sigma_x; \{R_1, R_1\};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	L-NS <sub>ZTR</sub> ;
	$\{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	L-NS <sub>ZTR</sub> ;
$\Sigma; \Gamma Y; \sigma_y, \mathcal{T}\sigma_x; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$\Delta; \Gamma\Delta; \sigma_x, \mathcal{T}C_{2z}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$B; ZB; \sigma_x, \mathcal{T}C_{2z}; \{R_1, R_2\};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	L-NS <sub>ZTR</sub> ;
$G; TG; \sigma_x, \mathcal{T}C_{2z}; \{R_1, R_2\};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	L-NS <sub>ZTR</sub> ;
$F; YF; \sigma_x, \mathcal{T}C_{2z}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$E; TE; \sigma_y, \mathcal{T}\sigma_x; \{R_1, R_1\};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	L-NS <sub>ZTR</sub> ;
	$\{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	L-NS <sub>ZTR</sub> ;
$C; YC; \sigma_y, \mathcal{T}\sigma_x; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	

SG 37

 $\Gamma_o^b; \{C_{2z}|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$Z; (00\frac{1}{2}); \sigma_x, C_{2z}, \mathcal{T}; \{R_2, R_4\};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2z}, \mathcal{T}; \{R_2, R_4\};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$S; (0\frac{1}{2}0); C_{2z}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Lambda; \Gamma Z; C_{2z}, \sigma_y; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$H; Y T; C_{2z}, \sigma_y; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$D; S R; C_{2z}; R_1;$	$R_1;$	1; 1;		
	$R_2;$	1; -1;		
$A; Z T; \sigma_y, \mathcal{T} \sigma_x; \{R_1, R_2\};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Sigma; \Gamma Y; \sigma_y, \mathcal{T} \sigma_x; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Delta; \Gamma \Delta; \sigma_x, \mathcal{T} C_{2z}; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$B; Z B; \sigma_x, \mathcal{T} C_{2z}; \{R_1, R_2\};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	WNL;	$\pi$
$G; T G; \sigma_x, \mathcal{T} C_{2z}; \{R_1, R_2\};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	WNL;	$\pi$
$F; Y F; \sigma_x, \mathcal{T} C_{2z}; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$E; T E; \sigma_y, \mathcal{T} \sigma_x; \{R_1, R_2\};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$C; Y C; \sigma_y, \mathcal{T} \sigma_x; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		

SG 38

 $\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{2y}, \sigma_x, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2y}, \sigma_x, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$Z; (00\frac{1}{2}); C_{2y}, \sigma_x, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2y}, \sigma_x, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$S; (0\frac{1}{2}0); \sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_z, \mathcal{T};$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$\Lambda; \Gamma Z; \sigma_x, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$H; Y T; \sigma_x, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$D; S R; E, \mathcal{T}\sigma_z;$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$A; Z T; \sigma_z, \mathcal{T}C_{2y};$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$\Sigma; \Gamma Y; \sigma_z, \mathcal{T}C_{2y};$	$R_1; 1; 1, 1;$
	$R_2; 1; -1, 1;$
$\Delta; \Gamma \Delta; C_{2y}, \sigma_x;$	$R_1; 1; 1, 1;$
	$R_2; 1; 1, -1;$
	$R_3; 1; -1, 1;$
	$R_4; 1; -1, -1;$
$B; Z B; C_{2y}, \sigma_x;$	$R_1; 1; 1, 1;$
	$R_2; 1; 1, -1;$
	$R_3; 1; -1, 1;$
	$R_4; 1; -1, -1;$
$G; T G; C_{2y}, \sigma_x;$	$R_1; 1; 1, 1;$
	$R_2; 1; 1, -1;$
	$R_3; 1; -1, 1;$
	$R_4; 1; -1, -1;$
$F; Y F; C_{2y}, \sigma_x;$	$R_1; 1; 1, 1;$
	$R_2; 1; 1, -1;$
	$R_3; 1; -1, 1;$
	$R_4; 1; -1, -1;$

$$\begin{aligned} E; \text{ TE}; \sigma_z, \mathcal{TC}_{2y}; R_1; 1; 1, 1; \\ R_2; 1; -1, 1; \\ C; \text{ YC}; \sigma_z, \mathcal{TC}_{2y}; R_1; 1; 1, 1; \\ R_2; 1; -1, 1; \end{aligned}$$

SG 39

 $\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{2y}, \sigma_x, \mathcal{T}; R_1;$	$1; 1, 1, 1;$	
	$R_2;$	$1; 1, -1, 1;$
	$R_3;$	$1; -1, 1, 1;$
	$R_4;$	$1; -1, -1, 1;$
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2y}, \sigma_x, \mathcal{T}; R_1;$	$1; 1, 1, 1;$	
	$R_2;$	$1; 1, -1, 1;$
	$R_3;$	$1; -1, 1, 1;$
	$R_4;$	$1; -1, -1, 1;$
$Z; (00\frac{1}{2}); C_{2y}, \sigma_x, \mathcal{T}; R_1;$	$1; 1, 1, 1;$	
	$R_2;$	$1; 1, -1, 1;$
	$R_3;$	$1; -1, 1, 1;$
	$R_4;$	$1; -1, -1, 1;$
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2y}, \sigma_x, \mathcal{T}; R_1;$	$1; 1, 1, 1;$	
	$R_2;$	$1; 1, -1, 1;$
	$R_3;$	$1; -1, 1, 1;$
	$R_4;$	$1; -1, -1, 1;$
$S; (0\frac{1}{2}0); \sigma_z, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-WNL;
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_z, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_1;$	P-WNL;
$\Lambda; \Gamma Z; \sigma_x, \mathcal{T}\sigma_z;$	$R_1;$	$1; 1, 1;$
	$R_2;$	$1; -1, 1;$
$H; Y T; \sigma_x, \mathcal{T}\sigma_z;$	$R_1;$	$1; -1, 1;$
	$R_2;$	$1; 1, 1;$
$D; S R; E, \mathcal{T}\sigma_z;$	$\{R_1, R_1\}; 2; \sigma_0, -i\sigma_2;$	WNL; $\pi$
$A; Z T; \sigma_z, \mathcal{T}C_{2y};$	$R_1;$	$1; 1, 1;$
	$R_2;$	$1; -1, 1;$
$\Sigma; \Gamma Y; \sigma_z, \mathcal{T}C_{2y};$	$R_1;$	$1; 1, 1;$
	$R_2;$	$1; -1, 1;$
$\Delta; \Gamma \Delta; C_{2y}, \sigma_x;$	$R_1;$	$1; 1, 1;$
	$R_2;$	$1; 1, -1;$
	$R_3;$	$1; -1, 1;$
	$R_4;$	$1; -1, -1;$
$B; Z B; C_{2y}, \sigma_x;$	$R_1;$	$1; 1, 1;$
	$R_2;$	$1; 1, -1;$
	$R_3;$	$1; -1, 1;$
	$R_4;$	$1; -1, -1;$
$G; T G; C_{2y}, \sigma_x;$	$R_1;$	$1; 1, -1;$
	$R_2;$	$1; 1, 1;$
	$R_3;$	$1; -1, -1;$
	$R_4;$	$1; -1, 1;$
$F; Y F; C_{2y}, \sigma_x;$	$R_1;$	$1; 1, -1;$
	$R_2;$	$1; 1, 1;$
	$R_3;$	$1; -1, -1;$
	$R_4;$	$1; -1, 1;$
$E; T E; \sigma_z, \mathcal{T}C_{2y};$	$R_1;$	$1; 1, 1;$
	$R_2;$	$1; -1, 1;$
$C; Y C; \sigma_z, \mathcal{T}C_{2y};$	$R_1;$	$1; 1, 1;$
	$R_2;$	$1; -1, 1;$

SG 40

 $\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_{2y}, \sigma_x, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2y}, \sigma_x, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$Z; (00\frac{1}{2}); \sigma_x, C_{2y}, \mathcal{T}; R_5;$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ; P-WNLs;		
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2y}, \mathcal{T}; R_5;$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ; P-WNLs;		
$S; (0\frac{1}{2}0); \sigma_z, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_z, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Lambda; \Gamma Z; \sigma_x, \mathcal{T}\sigma_z; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$H; Y T; \sigma_x, \mathcal{T}\sigma_z; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$D; S R; E, \mathcal{T}\sigma_z; R_1;$	$R_1;$	1; 1, 1;		
$A; Z T; \sigma_z, \mathcal{T}C_{2y}; \{R_2, R_4\}; 2; \sigma_3, \sigma_1;$		WNL; $\pi$		
$\Sigma; \Gamma Y; \sigma_z, \mathcal{T}C_{2y}; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Delta; \Gamma \Delta; C_{2y}, \sigma_x; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$B; Z B; \sigma_z, C_{2y}; R_5;$	$R_5;$	2; $\sigma_2, \sigma_3$ ; WNL; $\pi$		
$G; T G; \sigma_z, C_{2y}; R_5;$	$R_5;$	2; $\sigma_2, \sigma_3$ ; WNL; $\pi$		
$F; Y F; C_{2y}, \sigma_x; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$E; T E; \sigma_z, \mathcal{T}C_{2y}; \{R_2, R_4\}; 2; \sigma_3, \sigma_1;$		WNL; $\pi$		
$C; Y C; \sigma_z, \mathcal{T}C_{2y}; R_1;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		

## 6. SG 41-50

SG 41

 $\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{2y}, \sigma_x, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2y}, \sigma_x, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$Z; (00\frac{1}{2}); \sigma_x, C_{2y}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2y}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$S; (0\frac{1}{2}0); \sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	P-WNLs;	
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	P-WNLs;	
$\Lambda; \Gamma Z; \sigma_x, \mathcal{T}\sigma_z;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$H; YT; \sigma_x, \mathcal{T}\sigma_z;$	$R_1;$	1; -1, 1;		
	$R_2;$	1; 1, 1;		
$D; SR; E, \mathcal{T}\sigma_z;$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$A; ZT; \sigma_z, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma Y; \sigma_z, \mathcal{T}C_{2y};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$\Delta; \Gamma\Delta; C_{2y}, \sigma_x;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$B; ZB; \sigma_z, C_{2y};$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$
$G; TG; \sigma_z, C_{2y};$	$R_5;$	2; $-\sigma_2, \sigma_3;$	WNL;	$\pi$
$F; YF; C_{2y}, \sigma_x;$	$R_1;$	1; 1, -1;		
	$R_2;$	1; 1, 1;		
	$R_3;$	1; -1, -1;		
	$R_4;$	1; -1, 1;		
$E; TE; \sigma_z, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$C; YC; \sigma_z, \mathcal{T}C_{2y};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		



SG 42

 $\Gamma_o^f; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	$R_2; 1; 1, -1, 1;$
			$R_3; 1; -1, 1, 1;$
			$R_4; 1; -1, -1, 1;$
$Y; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	$R_2; 1; 1, -1, 1;$
			$R_3; 1; -1, 1, 1;$
			$R_4; 1; -1, -1, 1;$
$X; (\frac{1}{2}0\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	$R_2; 1; 1, -1, 1;$
			$R_3; 1; -1, 1, 1;$
			$R_4; 1; -1, -1, 1;$
$Z; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	$R_2; 1; 1, -1, 1;$
			$R_3; 1; -1, 1, 1;$
			$R_4; 1; -1, -1, 1;$
$L; (\frac{1}{2}00);$	$E, \mathcal{T};$	$R_1; 1; 1, 1;$	
$\Lambda; \Gamma Z/\Gamma \Lambda;$	$C_{2z}, \sigma_y;$	$R_1; 1; 1, 1;$	$R_2; 1; 1, -1;$
			$R_3; 1; -1, 1;$
			$R_4; 1; -1, -1;$
$G; XG/XY;$	$C_{2z}, \sigma_y;$	$R_1; 1; 1, 1;$	$R_2; 1; 1, -1;$
			$R_3; 1; -1, 1;$
			$R_4; 1; -1, -1;$
$H; YH/YX;$	$C_{2z}, \sigma_y;$	$R_1; 1; 1, 1;$	$R_2; 1; 1, -1;$
			$R_3; 1; -1, 1;$
			$R_4; 1; -1, -1;$
$Q; ZQ;$	$C_{2z}, \sigma_y;$	$R_1; 1; 1, 1;$	$R_2; 1; 1, -1;$
			$R_3; 1; -1, 1;$
			$R_4; 1; -1, -1;$
$\Sigma; \Gamma X/\Gamma \Sigma;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1; 1; 1, 1;$	$R_2; 1; -1, 1;$
$C; YC/YZ;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1; 1; 1, 1;$	$R_2; 1; -1, 1;$
$A; ZA/ZY;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1; 1; 1, 1;$	$R_2; 1; -1, 1;$
$U; XU;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1; 1; 1, 1;$	$R_2; 1; -1, 1;$
$\Delta; \Gamma Y/\Gamma \Delta;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$	$R_2; 1; -1, 1;$

$$\begin{aligned}
D; XD/XZ; \sigma_x, \mathcal{T}C_{2z}; R_1; 1; 1, 1; \\
R_2; 1; -1, 1; \\
B; ZB/ZX; \sigma_x, \mathcal{T}C_{2z}; R_1; 1; 1, 1; \\
R_2; 1; -1, 1; \\
R; YR; \sigma_x, \mathcal{T}C_{2z}; R_1; 1; 1, 1; \\
R_2; 1; -1, 1;
\end{aligned}$$

SG 43

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 $\Gamma_o^f; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|\frac{1}{2}00\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; (000); C_{2z}, \sigma_y, \mathcal{T}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
Y; (0\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2z}, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, -\sigma_0; \text{P-WNLs}; \\
X; (\frac{1}{2}0\frac{1}{2}); \sigma_y, C_{2z}, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, -\sigma_0; \text{P-WNLs}; \\
Z; (\frac{1}{2}\frac{1}{2}0); \sigma_x, C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, \sigma_1; \text{P-WNLs}; \\
\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, \sigma_1; \text{P-WNLs}; \\
L; (\frac{1}{2}00); E, \mathcal{T}; R_1; 1; 1, 1; \\
\Lambda; \Gamma Z/\Gamma\Lambda; C_{2z}, \sigma_y; R_1; 1; 1, 1; \\
R_2; 1; 1, -1; \\
R_3; 1; -1, 1; \\
R_4; 1; -1, -1; \\
G; XG/XY; C_{2z}, \sigma_y; R_5; 2; \sigma_2, -i\sigma_3; \text{WNL}; \pi \\
H; YH/YX; C_{2z}, \sigma_y; R_5; 2; -\sigma_2, \sigma_3; \text{WNL}; \pi \\
Q; ZQ; C_{2z}, \sigma_y, E; R_5; 1; 1, -i, 1; \\
R_6; 1; -1, -i, 1; \\
R_7; 1; 1, i, 1; \\
R_8; 1; -1, i, 1; \\
\Sigma; \Gamma X/\Gamma\Sigma; \sigma_y, \mathcal{T}\sigma_x; R_1; 1; 1, 1; \\
R_2; 1; -1, 1; \\
C; YC/YZ; \sigma_y, \mathcal{T}\sigma_x; \{R_1, R_2\}; 2; \sigma_3, -i\sigma_2; \text{WNL}; \pi \\
A; ZA/ZY; \sigma_y, \mathcal{T}\sigma_x; \{R_1, R_2\}; 2; -i\sigma_3, -i\sigma_2; \text{WNL}; \pi \\
U; XU; \sigma_y, \mathcal{T}\sigma_x; R_1; 1; -i, 1; \\
R_2; 1; i, 1; \\
\Delta; \Gamma Y/\Gamma\Delta; \sigma_x, \mathcal{T}C_{2z}; R_1; 1; 1, 1; \\
R_2; 1; -1, 1; \\
D; XD/XZ; \sigma_x, \mathcal{T}C_{2z}; \{R_1, R_2\}; 2; \sigma_3, \sigma_1; \text{WNL}; \pi \\
B; ZB/ZX; \sigma_x, \mathcal{T}C_{2z}; \{R_1, R_2\}; 2; -i\sigma_3, \sigma_1; \text{WNL}; \pi \\
R; YR; \sigma_x, \mathcal{T}C_{2z}; R_1; 1; -i, 1; \\
R_2; 1; i, 1;
\end{aligned}$$

SG 44

 $\Gamma_o^v; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$X; (\frac{1}{2}\frac{\bar{1}}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$R; (\frac{1}{2}00);$	$\sigma_y, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$S; (\frac{1}{2}0\frac{\bar{1}}{2});$	$\sigma_x, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$T; (\frac{1}{2}\frac{\bar{1}}{2}0);$	$C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$W; (\frac{3}{4}\frac{\bar{1}}{4}\frac{\bar{1}}{4});$	$C_{2z}, \mathcal{T}\sigma_x;$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$\Lambda; \Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y;$	$R_1; 1; 1, 1;$
		$R_2; 1; 1, -1;$
		$R_3; 1; -1, 1;$
		$R_4; 1; -1, -1;$
$G; XG;$	$C_{2z}, \sigma_y;$	$R_1; 1; 1, 1;$
		$R_2; 1; 1, -1;$
		$R_3; 1; -1, 1;$
		$R_4; 1; -1, -1;$
$P; TW;$	$C_{2z};$	$R_1; 1; 1;$
		$R_2; 1; -1;$
$\Sigma; \Gamma\Sigma/\Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$F; XF;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$D; SW;$	$E, \mathcal{T}\sigma_x;$	$R_1; 1; 1, 1;$
$\Delta; \Gamma\Delta/\Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$U; XU;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$Q; RW;$	$E, \mathcal{T}\sigma_y;$	$R_1; 1; 1, 1;$

SG 45

 $\Gamma_o^v; \{C_{2z}|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$ (000);	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
$X;$ ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
$R;$ ( $\frac{1}{2}00$ );	$\sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	P-WNLs;
$S;$ ( $\frac{1}{2}0\frac{1}{2}$ );	$\sigma_x, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	P-WNLs;
$T;$ ( $\frac{1}{2}\frac{1}{2}0$ );	$C_{2z}, \mathcal{T};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
$W;$ ( $\frac{3}{4}\frac{1}{4}\frac{1}{4}$ );	$C_{2z}, \mathcal{T}\sigma_x;$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	P-WNLs;
		$\{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	P-WNLs;
$\Lambda;$ $\Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;	
		$R_2;$	1; 1, -1;	
		$R_3;$	1; -1, 1;	
		$R_4;$	1; -1, -1;	
$G;$ XG;	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;	
		$R_2;$	1; 1, -1;	
		$R_3;$	1; -1, 1;	
		$R_4;$	1; -1, -1;	
$P;$ TW;	$C_{2z};$	$R_1;$	1; 1;	
		$R_2;$	1; -1;	
$\Sigma;$ $\Gamma\Sigma/\Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
$F;$ XF;	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
$D;$ SW;	$E, \mathcal{T}\sigma_x;$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL; $\pi$
$\Delta;$ $\Gamma\Delta/\Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
$U;$ XU;	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
$Q;$ RW;	$E, \mathcal{T}\sigma_y;$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL; $\pi$

SG 46

 $\Gamma_o^v; \{C_{2z}|000\}, \{\sigma_y|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;
		$R_2;$	1; 1, -1, 1;
		$R_3;$	1; -1, 1, 1;
		$R_4;$	1; -1, -1, 1;
$X; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;
		$R_2;$	1; 1, -1, 1;
		$R_3;$	1; -1, 1, 1;
		$R_4;$	1; -1, -1, 1;
$R; (\frac{1}{2}00);$	$\sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1;
		$R_2;$	1; -1, 1;
$S; (\frac{1}{2}0\frac{1}{2});$	$\sigma_x, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$ P-WNLs;
$T; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$R_1;$	1; 1, 1;
		$R_2;$	1; -1, 1;
$W; (\frac{3}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$ P-WNL;
$\Lambda; \Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;
		$R_2;$	1; 1, -1;
		$R_3;$	1; -1, 1;
		$R_4;$	1; -1, -1;
$G; XG;$	$C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;
		$R_2;$	1; 1, -1;
		$R_3;$	1; -1, 1;
		$R_4;$	1; -1, -1;
$P; TW;$	$C_{2z};$	$R_1;$	1; 1;
		$R_2;$	1; -1;
$\Sigma; \Gamma\Sigma/\Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;
		$R_2;$	1; -1, 1;
$F; XF;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; -1, 1;
		$R_2;$	1; 1, 1;
$D; SW;$	$E, \mathcal{T}\sigma_x;$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$ WNL; $\pi$
$\Delta; \Gamma\Delta/\Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;
		$R_2;$	1; -1, 1;
$U; XU;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;
		$R_2;$	1; -1, 1;
$Q; RW;$	$E, \mathcal{T}\sigma_y;$	$R_1;$	1; 1, 1;

SG 47

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$

$Y; (\bar{1}00); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$

$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$

$Z; (00\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$

$U; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$

$$\begin{aligned}
T; \left(\bar{\frac{1}{2}}0\frac{1}{2}\right); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1; \\
R_2; 1; -1, 1, 1, 1; \\
R_3; 1; 1, -1, 1, 1; \\
R_4; 1; -1, -1, 1, 1; \\
R_5; 1; 1, 1, -1, 1; \\
R_6; 1; -1, 1, -1, 1; \\
R_7; 1; 1, -1, -1, 1; \\
R_8; 1; -1, -1, -1, 1; \\
S; \left(\bar{\frac{1}{2}}\frac{1}{2}0\right); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1; \\
R_2; 1; -1, 1, 1, 1; \\
R_3; 1; 1, -1, 1, 1; \\
R_4; 1; -1, -1, 1, 1; \\
R_5; 1; 1, 1, -1, 1; \\
R_6; 1; -1, 1, -1, 1; \\
R_7; 1; 1, -1, -1, 1; \\
R_8; 1; -1, -1, -1, 1; \\
R; \left(\bar{\frac{1}{2}}\frac{1}{2}\frac{1}{2}\right); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1; \\
R_2; 1; -1, 1, 1, 1; \\
R_3; 1; 1, -1, 1, 1; \\
R_4; 1; -1, -1, 1, 1; \\
R_5; 1; 1, 1, -1, 1; \\
R_6; 1; -1, 1, -1, 1; \\
R_7; 1; 1, -1, -1, 1; \\
R_8; 1; -1, -1, -1, 1; \\
\Delta; \Gamma Y; C_{2y}, \sigma_x, I\mathcal{T}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
D; X S; C_{2y}, \sigma_x, I\mathcal{T}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
P; U R; C_{2y}, \sigma_x, I\mathcal{T}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
B; Z T; C_{2y}, \sigma_x, I\mathcal{T}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
\Sigma; \Gamma X; C_{2x}, \sigma_z, I\mathcal{T}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
C; Y S; C_{2x}, \sigma_z, I\mathcal{T}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1;
\end{aligned}$$

$$\begin{aligned}
E; \text{ TR}; C_{2x, \sigma_z, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
A; \text{ ZU}; C_{2x, \sigma_z, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
\Lambda; \text{ } \Gamma\text{Z}; C_{2z, \sigma_y, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
H; \text{ YT}; C_{2z, \sigma_y, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
Q; \text{ SR}; C_{2z, \sigma_y, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
G; \text{ XU}; C_{2z, \sigma_y, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1;
\end{aligned}$$



SG 48

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$		
		$R_2; 1; -1, 1, 1, 1;$		
		$R_3; 1; 1, -1, 1, 1;$		
		$R_4; 1; -1, -1, 1, 1;$		
		$R_5; 1; 1, 1, -1, 1;$		
		$R_6; 1; -1, 1, -1, 1;$		
		$R_7; 1; 1, -1, -1, 1;$		
		$R_8; 1; -1, -1, -1, 1;$		
$Y; (\bar{1}00);$	$\sigma_z, I, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
		$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0);$	$\sigma_y, I, C_{2x}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
		$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2});$	$\sigma_x, I, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
		$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_z, I, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
		$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$T; (\bar{1}0\frac{1}{2});$	$\sigma_y, I, C_{2x}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
		$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$S; (\bar{1}\frac{1}{2}0);$	$\sigma_x, I, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
		$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$R; (\bar{1}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$		
		$R_2; 1; -1, 1, 1, 1;$		
		$R_3; 1; 1, -1, 1, 1;$		
		$R_4; 1; -1, -1, 1, 1;$		
		$R_5; 1; 1, 1, -1, 1;$		
		$R_6; 1; -1, 1, -1, 1;$		
		$R_7; 1; 1, -1, -1, 1;$		
		$R_8; 1; -1, -1, -1, 1;$		
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$		
		$R_2; 1; 1, -1, 1;$		
		$R_3; 1; -1, 1, 1;$		
		$R_4; 1; -1, -1, 1;$		
$D; X S;$	$\sigma_x, C_{2y}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$P; U R;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$R_2; 1; -i, 1, 1;$		
		$R_4; 1; i, 1, 1;$		
		$R_6; 1; -i, -1, 1;$		
		$R_8; 1; i, -1, 1;$		
$B; Z T;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$		
		$R_2; 1; 1, -1, 1;$		
		$R_3; 1; -1, 1, 1;$		
		$R_4; 1; -1, -1, 1;$		
$C; Y S;$	$\sigma_y, C_{2x}, I\mathcal{T};$	$R_5; 2; -\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$

$E$ ; TR;  $\sigma_z, C_{2x}, I\mathcal{T}$ ;  $R_2$ ; 1;  $i, 1, 1$ ;  
 $R_4$ ; 1;  $-i, 1, 1$ ;  
 $R_6$ ; 1;  $i, -1, 1$ ;  
 $R_8$ ; 1;  $-i, -1, 1$ ;  
 $A$ ; ZU;  $\sigma_z, C_{2x}, I\mathcal{T}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \sigma_y, I\mathcal{T}$ ;  $R_1$ ; 1;  $1, 1, 1$ ;  
 $R_2$ ; 1;  $1, -1, 1$ ;  
 $R_3$ ; 1;  $-1, 1, 1$ ;  
 $R_4$ ; 1;  $-1, -1, 1$ ;  
 $H$ ; YT;  $\sigma_y, C_{2z}, I\mathcal{T}$ ;  $R_5$ ; 2;  $-\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $Q$ ; SR;  $\sigma_x, C_{2z}, I\mathcal{T}$ ;  $R_2$ ; 1;  $i, 1, 1$ ;  
 $R_4$ ; 1;  $-i, 1, 1$ ;  
 $R_6$ ; 1;  $i, -1, 1$ ;  
 $R_8$ ; 1;  $-i, -1, 1$ ;  
 $G$ ; XU;  $\sigma_x, C_{2z}, I\mathcal{T}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$

SG 49

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

- $\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$
- $Y; (\bar{1}200); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$
- $X; (0\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$
- $Z; (00\frac{1}{2}); \sigma_x, I, C_{2z}, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-WNLs};$   
 $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-WNLs};$
- $U; (0\frac{1}{2}\frac{1}{2}); \sigma_x, I, C_{2z}, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-WNLs};$   
 $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-WNLs};$
- $T; (\bar{1}20\frac{1}{2}); \sigma_x, I, C_{2z}, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-WNLs};$   
 $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-WNLs};$
- $S; (\bar{1}2\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$
- $R; (\bar{1}2\frac{1}{2}\frac{1}{2}); \sigma_x, I, C_{2z}, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-WNLs};$   
 $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-WNLs};$
- $\Delta; \Gamma Y; C_{2y}, \sigma_x, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$D$ ; XS;  $C_{2y,\sigma_x,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $P$ ; UR;  $\sigma_z, C_{2y,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $B$ ; ZT;  $\sigma_z, C_{2y,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $\Sigma$ ;  $\Gamma X$ ;  $C_{2x,\sigma_z,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $C$ ; YS;  $C_{2x,\sigma_z,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $E$ ; TR;  $\sigma_z, C_{2x,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $A$ ; ZU;  $\sigma_z, C_{2x,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z,\sigma_y,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $H$ ; YT;  $C_{2z,\sigma_y,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $Q$ ; SR;  $C_{2z,\sigma_y,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $G$ ; XU;  $C_{2z,\sigma_y,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;

SG 50

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$		
	$R_2; 1; -1, 1, 1, 1;$		
	$R_3; 1; 1, -1, 1, 1;$		
	$R_4; 1; -1, -1, 1, 1;$		
	$R_5; 1; 1, 1, -1, 1;$		
	$R_6; 1; -1, 1, -1, 1;$		
	$R_7; 1; 1, -1, -1, 1;$		
	$R_8; 1; -1, -1, -1, 1;$		
$Y; (\bar{1}00); \sigma_z, I, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0); \sigma_z, I, C_{2x}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$		
	$R_2; 1; -1, 1, 1, 1;$		
	$R_3; 1; 1, -1, 1, 1;$		
	$R_4; 1; -1, -1, 1, 1;$		
	$R_5; 1; 1, 1, -1, 1;$		
	$R_6; 1; -1, 1, -1, 1;$		
	$R_7; 1; 1, -1, -1, 1;$		
	$R_8; 1; -1, -1, -1, 1;$		
$U; (0\frac{1}{2}\frac{1}{2}); \sigma_z, I, C_{2x}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$T; (\bar{1}0\frac{1}{2}); \sigma_z, I, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$S; (\bar{1}\frac{1}{2}0); \sigma_x, I, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$R; (\bar{1}\frac{1}{2}\frac{1}{2}); \sigma_x, I, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma Y; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 1; -1, 1, 1;$		
	$R_4; 1; -1, -1, 1;$		
$D; X S; \sigma_x, C_{2y}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$P; U R; \sigma_x, C_{2y}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$B; Z T; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 1; -1, 1, 1;$		
	$R_4; 1; -1, -1, 1;$		
$\Sigma; \Gamma X; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 1; -1, 1, 1;$		
	$R_4; 1; -1, -1, 1;$		
$C; Y S; \sigma_y, C_{2x}, I\mathcal{T};$	$R_5; 2; -\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$E; T R; \sigma_y, C_{2x}, I\mathcal{T};$	$R_5; 2; -\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$

$A$ ; ZU;  $C_{2x,\sigma_z,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z,\sigma_y,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $H$ ; YT;  $\sigma_y, C_{2z,IT}$ ;  $R_5$ ; 2;  $-\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $Q$ ; SR;  $\sigma_y, C_{2z,IT}$ ;  $R_2$ ; 1;  $i$ , 1, 1;  
 $R_4$ ; 1;  $-i$ , 1, 1;  
 $R_6$ ; 1;  $i$ , -1, 1;  
 $R_8$ ; 1;  $-i$ , -1, 1;  
 $G$ ; XU;  $\sigma_x, C_{2z,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$

SG 51

 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC $\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$  $R_2; 1; -1, 1, 1, 1;$  $R_3; 1; 1, -1, 1, 1;$  $R_4; 1; -1, -1, 1, 1;$  $R_5; 1; 1, 1, -1, 1;$  $R_6; 1; -1, 1, -1, 1;$  $R_7; 1; 1, -1, -1, 1;$  $R_8; 1; -1, -1, -1, 1;$  $Y; (\bar{1}00); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$  $R_2; 1; -1, 1, 1, 1;$  $R_3; 1; 1, -1, 1, 1;$  $R_4; 1; -1, -1, 1, 1;$  $R_5; 1; 1, 1, -1, 1;$  $R_6; 1; -1, 1, -1, 1;$  $R_7; 1; 1, -1, -1, 1;$  $R_8; 1; -1, -1, -1, 1;$  $X; (0\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$  $R_2; 1; -1, 1, 1, 1;$  $R_3; 1; 1, -1, 1, 1;$  $R_4; 1; -1, -1, 1, 1;$  $R_5; 1; 1, 1, -1, 1;$  $R_6; 1; -1, 1, -1, 1;$  $R_7; 1; 1, -1, -1, 1;$  $R_8; 1; -1, -1, -1, 1;$  $Z; (00\frac{1}{2}); C_{2z}, I, \sigma_y, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-NS}_{ZUTR};$  $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-NS}_{ZUTR};$  $U; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \sigma_y, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-NS}_{ZUTR};$  $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-NS}_{ZUTR};$  $T; (\bar{1}0\frac{1}{2}); C_{2z}, I, \sigma_y, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-NS}_{ZUTR};$  $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-NS}_{ZUTR};$  $S; (\bar{1}\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$  $R_2; 1; -1, 1, 1, 1;$  $R_3; 1; 1, -1, 1, 1;$  $R_4; 1; -1, -1, 1, 1;$  $R_5; 1; 1, 1, -1, 1;$  $R_6; 1; -1, 1, -1, 1;$  $R_7; 1; 1, -1, -1, 1;$  $R_8; 1; -1, -1, -1, 1;$  $R; (\bar{1}\frac{1}{2}\frac{1}{2}); C_{2z}, I, \sigma_y, \mathcal{T}; R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-NS}_{ZUTR};$  $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-NS}_{ZUTR};$

$\Delta$ ; $\Gamma Y$ ; $C_{2y,\sigma_x,IT}$ ; $R_1$ ;	1; 1, 1, 1;
$R_2$ ;	1; 1, -1, 1;
$R_3$ ;	1; -1, 1, 1;
$R_4$ ;	1; -1, -1, 1;
$D$ ; $XS$ ; $C_{2y,\sigma_x,IT}$ ; $R_1$ ;	1; 1, 1, 1;
$R_2$ ;	1; 1, -1, 1;
$R_3$ ;	1; -1, 1, 1;
$R_4$ ;	1; -1, -1, 1;
$P$ ; $UR$ ; $\sigma_z, C_{2y,IT}$ ; $R_5$ ;	2; $\sigma_2, \sigma_3, -\sigma_0$ ; L-NS <sub>ZUTR</sub> ;
$B$ ; $ZT$ ; $\sigma_z, C_{2y,IT}$ ; $R_5$ ;	2; $\sigma_2, \sigma_3, -\sigma_0$ ; L-NS <sub>ZUTR</sub> ;
$\Sigma$ ; $\Gamma X$ ; $C_{2x,\sigma_z,IT}$ ; $R_1$ ;	1; 1, 1, 1;
$R_2$ ;	1; 1, -1, 1;
$R_3$ ;	1; -1, 1, 1;
$R_4$ ;	1; -1, -1, 1;
$C$ ; $YS$ ; $C_{2x,\sigma_z,IT}$ ; $R_1$ ;	1; 1, 1, 1;
$R_2$ ;	1; 1, -1, 1;
$R_3$ ;	1; -1, 1, 1;
$R_4$ ;	1; -1, -1, 1;
$E$ ; $TR$ ; $C_{2x,\sigma_y,IT}$ ; $\{R_2, R_4\}$ ; 2; $\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;
$\{R_6, R_8\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;
$A$ ; $ZU$ ; $C_{2x,\sigma_y,IT}$ ; $\{R_2, R_4\}$ ; 2; $\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;
$\{R_6, R_8\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z,\sigma_y,IT}$ ; $R_1$ ;	1; 1, 1, 1;
$R_2$ ;	1; 1, -1, 1;
$R_3$ ;	1; -1, 1, 1;
$R_4$ ;	1; -1, -1, 1;
$H$ ; $YT$ ; $C_{2z,\sigma_y,IT}$ ; $R_1$ ;	1; 1, 1, 1;
$R_2$ ;	1; 1, -1, 1;
$R_3$ ;	1; -1, 1, 1;
$R_4$ ;	1; -1, -1, 1;
$Q$ ; $SR$ ; $C_{2z,\sigma_y,IT}$ ; $R_1$ ;	1; 1, 1, 1;
$R_2$ ;	1; 1, -1, 1;
$R_3$ ;	1; -1, 1, 1;
$R_4$ ;	1; -1, -1, 1;
$G$ ; $XU$ ; $C_{2z,\sigma_y,IT}$ ; $R_1$ ;	1; 1, 1, 1;
$R_2$ ;	1; 1, -1, 1;
$R_3$ ;	1; -1, 1, 1;
$R_4$ ;	1; -1, -1, 1;



SG 52

 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; -1, 1, 1, 1;		
	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
$Y; (\bar{1}200); \sigma_z, I, C_{2y}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0); \sigma_y, I, C_{2x}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2}); \sigma_x, I, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;	
$U; (0\frac{1}{2}\frac{1}{2}); \sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	DP;	0
$T; (\bar{1}20\frac{1}{2}); \sigma_z, \sigma_y, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNL/NS;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNL/NS;	
$S; (\bar{1}2\frac{1}{2}0); \sigma_x, I, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$R; (\bar{1}2\frac{1}{2}\frac{1}{2}); \sigma_y, I, \sigma_x, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;	
$\Delta; \Gamma Y; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$D; XS; \sigma_x, C_{2y}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$P; UR; \sigma_z, C_{2y}, I\mathcal{T};$	$\{R_2, R_8\};$	2; $-i\sigma_3, \sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
	$\{R_4, R_6\};$	2; $i\sigma_3, \sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
$B; ZT; \sigma_z, C_{2y}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -\sigma_0;$	L-NS <sub>ZUTR</sub> ;	
$\Sigma; \Gamma X; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$C; YS; \sigma_y, C_{2x}, I\mathcal{T};$	$R_5;$	2; $-\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$E; TR; \sigma_y, \sigma_z, I\mathcal{T};$	$R_5;$	2; $-\sigma_2, i\sigma_1, -i\sigma_3;$	L-NS <sub>ZUTR</sub> ;	
$A; ZU; C_{2x}, \sigma_y, I\mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_0, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
	$\{R_6, R_8\};$	2; $\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$H; YT; \sigma_y, C_{2z}, I\mathcal{T};$	$R_5;$	2; $-\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$

$$\begin{aligned} Q; \text{ SR}; \sigma_y, C_{2z}, IT; R_2; 1; i, 1, 1; \\ R_4; 1; -i, 1, 1; \\ R_6; 1; i, -1, 1; \\ R_8; 1; -i, -1, 1; \\ G; \text{ XU}; \sigma_x, C_{2z}, IT; R_5; 2; \sigma_2, \sigma_3, -i\sigma_1; \text{ WNL}; \pi \end{aligned}$$

SG 53

 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; -1, 1, 1, 1;$	
	$R_3; 1; 1, -1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 1; 1, 1, -1, 1;$	
	$R_6; 1; -1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, -1, -1, 1;$	
$Y; (\bar{1}00); \sigma_z, I, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; -1, 1, 1, 1;$	
	$R_3; 1; 1, -1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 1; 1, 1, -1, 1;$	
	$R_6; 1; -1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, -1, -1, 1;$	
$Z; (00\frac{1}{2}); C_{2z}, I, \sigma_y, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;
$U; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \sigma_y, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;
$T; (\bar{1}0\frac{1}{2}); C_{2z}, \sigma_y, I, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNL/NS;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNL/NS;
$S; (\bar{1}\frac{1}{2}0); \sigma_z, I, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;
$R; (\bar{1}\frac{1}{2}\frac{1}{2}); C_{2z}, \sigma_y, I, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNL/NS;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNL/NS;
$\Delta; \Gamma Y; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$D; X S; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$P; UR; \sigma_z, C_{2y}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -\sigma_0;$	L-NS <sub>ZUTR</sub> ;
$B; ZT; \sigma_z, C_{2y}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -\sigma_0;$	L-NS <sub>ZUTR</sub> ;
$\Sigma; \Gamma X; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$C; YS; \sigma_y, C_{2x}, I\mathcal{T};$	$R_5; 2; -\sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$
$E; TR; \sigma_y, C_{2x}, I\mathcal{T};$	$R_5; 2; -\sigma_2, \sigma_1, -i\sigma_1;$	L-NS <sub>ZUTR</sub> ;

$A$ ; ZU; $C_{2x,\sigma_y,IT}$ ; $\{R_2, R_4\}$ ; 2; $\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;	
$\{R_6, R_8\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;	
$\Lambda$ ; $\Gamma Z$ ; $C_{2z,\sigma_y,IT}$ ; $R_1$ ;	1; 1, 1, 1;	
$R_2$ ;	1; 1, -1, 1;	
$R_3$ ;	1; -1, 1, 1;	
$R_4$ ;	1; -1, -1, 1;	
$H$ ; YT; $\sigma_y, C_{2z,IT}$ ; $R_5$ ;	2; $-\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;	$\pi$
$Q$ ; SR; $\sigma_y, C_{2z,IT}$ ; $R_5$ ;	2; $-\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;	$\pi$
$G$ ; XU; $C_{2z,\sigma_y,IT}$ ; $R_1$ ;	1; 1, 1, 1;	
$R_2$ ;	1; 1, -1, 1;	
$R_3$ ;	1; -1, 1, 1;	
$R_4$ ;	1; -1, -1, 1;	

SG 54

 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|0\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; -1, 1, 1, 1;		
	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
$Y; (\bar{1}00); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; -1, 1, 1, 1;		
	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
$X; (0\frac{1}{2}0); \sigma_y, I, C_{2x}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2}); C_{2z}, I, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$U; (0\frac{1}{2}\frac{1}{2}); \sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	DP;	0
$T; (\bar{1}0\frac{1}{2}); C_{2z}, I, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>ZUTR</sub> ;	
$S; (\bar{1}\frac{1}{2}0); \sigma_y, I, C_{2x}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$R; (\bar{1}\frac{1}{2}\frac{1}{2}); \sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	DP;	0
$\Delta; \Gamma Y; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$D; XS; \sigma_x, C_{2y}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$P; UR; \sigma_x, C_{2y}, I\mathcal{T};$	$\{R_2, R_6\};$	2; $-i\sigma_0, \sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
	$\{R_4, R_8\};$	2; $i\sigma_0, \sigma_3, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
$B; ZT; \sigma_z, C_{2y}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -\sigma_0;$	L-NS <sub>ZUTR</sub> ;	
$\Sigma; \Gamma X; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$C; YS; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$E; TR; C_{2x}, \sigma_y, I\mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_0, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
	$\{R_6, R_8\};$	2; $\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
$A; ZU; C_{2x}, \sigma_y, I\mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_0, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	
	$\{R_6, R_8\};$	2; $\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>ZUTR</sub> ;	

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z,\sigma_y,IT}$ ;  $R_1$ ; 1; 1, 1, 1;

$R_2$ ; 1; 1, -1, 1;

$R_3$ ; 1; -1, 1, 1;

$R_4$ ; 1; -1, -1, 1;

$H$ ;  $YT$ ;  $C_{2z,\sigma_y,IT}$ ;  $R_1$ ; 1; 1, 1, 1;

$R_2$ ; 1; 1, -1, 1;

$R_3$ ; 1; -1, 1, 1;

$R_4$ ; 1; -1, -1, 1;

$Q$ ;  $SR$ ;  $\sigma_x, C_{2z,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ;  $WNL$ ;  $\pi$

$G$ ;  $XU$ ;  $\sigma_x, C_{2z,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ;  $WNL$ ;  $\pi$

SG 55

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; -1, 1, 1, 1;	
	$R_3;$	1; 1, -1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	1; 1, 1, -1, 1;	
	$R_6;$	1; -1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, -1, -1, 1;	
$Y; (\bar{1}200); \sigma_x, I, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
$X; (0\frac{1}{2}0); \sigma_y, I, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
$Z; (00\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; -1, 1, 1, 1;	
	$R_3;$	1; 1, -1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	1; 1, 1, -1, 1;	
	$R_6;$	1; -1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, -1, -1, 1;	
$U; (0\frac{1}{2}\frac{1}{2}); \sigma_y, I, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
$T; (\bar{1}20\frac{1}{2}); \sigma_x, I, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
$S; (\bar{1}2\frac{1}{2}0); C_{2x}, C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_{10}, R_{12}\};$	2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$\{R_{14}, R_{16}\};$	2; $i\sigma_3, -\sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
$R; (\bar{1}2\frac{1}{2}\frac{1}{2}); C_{2x}, C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_{10}, R_{12}\};$	2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$\{R_{14}, R_{16}\};$	2; $i\sigma_3, -\sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
$\Delta; \Gamma Y; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$D; X S; C_{2y}, \sigma_z, I, \mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_0, \sigma_1;$	L-NS <sub>XUSR</sub> ;
	$\{R_6, R_8\};$	2; $\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>XUSR</sub> ;
$P; U R; C_{2y}, \sigma_z, I, \mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_0, \sigma_1;$	L-NS <sub>XUSR</sub> ;
	$\{R_6, R_8\};$	2; $\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>XUSR</sub> ;
$B; Z T; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	

$\Sigma$ ; $\Gamma X$ ; $C_{2x, \sigma_z, IT}$ ; $R_1$ ;	1; 1, 1, 1;
$R_2$ ;	1; 1, -1, 1;
$R_3$ ;	1; -1, 1, 1;
$R_4$ ;	1; -1, -1, 1;
$C$ ; $YS$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_2, R_4\}$ ; 2; $-\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;
$\{R_6, R_8\}$ ; 2; $-\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;
$E$ ; $TR$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_2, R_4\}$ ; 2; $-\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;
$\{R_6, R_8\}$ ; 2; $-\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;
$A$ ; $ZU$ ; $C_{2x, \sigma_z, IT}$ ; $R_1$ ;	1; 1, 1, 1;
$R_2$ ;	1; 1, -1, 1;
$R_3$ ;	1; -1, 1, 1;
$R_4$ ;	1; -1, -1, 1;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $R_1$ ;	1; 1, 1, 1;
$R_2$ ;	1; 1, -1, 1;
$R_3$ ;	1; -1, 1, 1;
$R_4$ ;	1; -1, -1, 1;
$H$ ; $YT$ ; $\sigma_y, C_{2z, IT}$ ; $R_5$ ;	2; $-\sigma_2, \sigma_3, -\sigma_0$ ; L-NS <sub>YTSR</sub> ;
$Q$ ; $SR$ ; $\sigma_y, C_{2z, IT}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_1$ ;	L-NSs;
$\{R_6, R_8\}$ ; 2; $i\sigma_3, -\sigma_0, \sigma_1$ ;	L-NSs;
$G$ ; $XU$ ; $\sigma_x, C_{2z, IT}$ ; $R_5$ ;	2; $\sigma_2, \sigma_3, -\sigma_0$ ; L-NS <sub>XUSR</sub> ;



SG 56

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; -1, 1, 1, 1;	
	$R_3;$	1; 1, -1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	1; 1, 1, -1, 1;	
	$R_6;$	1; -1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, -1, -1, 1;	
$Y; (\bar{1}00); \sigma_z, I, \sigma_x, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
$X; (0\frac{1}{2}0); \sigma_z, I, \sigma_y, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
$Z; (00\frac{1}{2}); \sigma_x, I, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;
$U; (0\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	DP; 0
$T; (\bar{1}0\frac{1}{2}); \sigma_y, C_{2z}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	DP; 0
$S; (\bar{1}\frac{1}{2}0); C_{2y}, I, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NSs;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NSs;
$R; (\bar{1}\frac{1}{2}\frac{1}{2}); C_{2x}, C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_{10}, R_{12}\};$	2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$\{R_{14}, R_{16}\};$	2; $i\sigma_3, -\sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
$\Delta; \Gamma Y; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$D; X S; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	L-NS <sub>XUSR</sub> ;
$P; U R; C_{2y}, \sigma_x, I, \mathcal{T};$	$\{R_2, R_8\};$	2; $\sigma_3, -i\sigma_3, \sigma_1;$	L-NS <sub>XUSR</sub> ;
	$\{R_4, R_6\};$	2; $-\sigma_3, -i\sigma_3, \sigma_1;$	L-NS <sub>XUSR</sub> ;
$B; Z T; \sigma_z, C_{2y}, I, \mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$
$\Sigma; \Gamma X; C_{2x}, \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$C; Y S; C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	2; $-\sigma_2, i\sigma_3, -i\sigma_3;$	L-NS <sub>YTSR</sub> ;
$E; T R; C_{2x}, \sigma_y, I, \mathcal{T};$	$\{R_2, R_8\};$	2; $-\sigma_3, -i\sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
	$\{R_4, R_6\};$	2; $\sigma_3, -i\sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
$A; Z U; \sigma_z, C_{2x}, I, \mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$H; Y T; C_{2z}, \sigma_y, I, \mathcal{T};$	$\{R_1, R_4\};$	2; $\sigma_3, \sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
	$\{R_2, R_3\};$	2; $\sigma_3, -\sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;

$Q$ ; SR;  $C_{2z, \sigma_y, I\mathcal{T}}$ ;  $\{R_1, R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_1$ ; L-NSs;  
 $\{R_3, R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_1$ ; L-NSs;  
 $G$ ; XU;  $C_{2z, \sigma_y, I\mathcal{T}}$ ;  $\{R_1, R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_1$ ; L-NS $_{XUSR}$ ;  
 $\{R_2, R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_1$ ; L-NS $_{XUSR}$ ;

SG 57

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|0\frac{1}{2}0\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; (000); $C_{2z}, C_{2y}, I, \mathcal{T}$ ; $R_1$ ;		1; 1, 1, 1, 1;	
	$R_2$ ;	1; -1, 1, 1, 1;	
	$R_3$ ;	1; 1, -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1, 1;	
	$R_5$ ;	1; 1, 1, -1, 1;	
	$R_6$ ;	1; -1, 1, -1, 1;	
	$R_7$ ;	1; 1, -1, -1, 1;	
	$R_8$ ;	1; -1, -1, -1, 1;	
$Y$ ; ( $\bar{1}\frac{1}{2}00$ ); $\sigma_x, I, \sigma_z, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NS <sub>YTSR</sub> ;
	$R_{10}$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NS <sub>YTSR</sub> ;
$X$ ; ( $0\frac{1}{2}0$ ); $\sigma_z, I, \sigma_y, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NS <sub>XUSR</sub> ;
	$R_{10}$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NS <sub>XUSR</sub> ;
$Z$ ; ( $00\frac{1}{2}$ ); $C_{2z}, C_{2y}, I, \mathcal{T}$ ; $R_1$ ;		1; 1, 1, 1, 1;	
	$R_2$ ;	1; -1, 1, 1, 1;	
	$R_3$ ;	1; 1, -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1, 1;	
	$R_5$ ;	1; 1, 1, -1, 1;	
	$R_6$ ;	1; -1, 1, -1, 1;	
	$R_7$ ;	1; 1, -1, -1, 1;	
	$R_8$ ;	1; -1, -1, -1, 1;	
$U$ ; ( $0\frac{1}{2}\frac{1}{2}$ ); $\sigma_z, I, \sigma_y, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NS <sub>XUSR</sub> ;
	$R_{10}$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NS <sub>XUSR</sub> ;
$T$ ; ( $\bar{1}\frac{1}{2}0\frac{1}{2}$ ); $\sigma_x, I, \sigma_z, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NS <sub>YTSR</sub> ;
	$R_{10}$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NS <sub>YTSR</sub> ;
$S$ ; ( $\bar{1}\frac{1}{2}\frac{1}{2}0$ ); $C_{2x}, C_{2z}, I, \mathcal{T}$ ; $\{R_9, R_{10}\}$ ;	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0}$ ;	P-DNL <sub>SR</sub> ;	
$R$ ; ( $\bar{1}\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $C_{2x}, C_{2z}, I, \mathcal{T}$ ; $\{R_9, R_{10}\}$ ;	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0}$ ;	P-DNL <sub>SR</sub> ;	
$\Delta$ ; $\Gamma Y$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ; $R_1$ ;		1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
$D$ ; XS; $C_{2y}, \sigma_x, I\mathcal{T}$ ; $R_5$ ;	2; $\sigma_2, \sigma_3, -i\sigma_1$ ;	L-NS <sub>XUSR</sub> ;	
$P$ ; UR; $C_{2y}, \sigma_x, I\mathcal{T}$ ; $R_5$ ;	2; $\sigma_2, \sigma_3, -i\sigma_1$ ;	L-NS <sub>XUSR</sub> ;	
$B$ ; ZT; $C_{2y}, \sigma_x, I\mathcal{T}$ ; $R_1$ ;		1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
$\Sigma$ ; $\Gamma X$ ; $C_{2x}, \sigma_z, I\mathcal{T}$ ; $R_1$ ;		1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
$C$ ; YS; $C_{2x}, \sigma_z, I\mathcal{T}$ ; $\{R_2, R_4\}$ ;	2; $-\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;	
	$\{R_6, R_8\}$ ;	2; $-\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;
$E$ ; TR; $C_{2x}, \sigma_z, I\mathcal{T}$ ; $\{R_2, R_4\}$ ;	2; $-\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;	
	$\{R_6, R_8\}$ ;	2; $-\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;

$A$ ; ZU; $C_{2x, \sigma_z, I\mathcal{T}}$ ; $R_1$ ;	$1$ ; $1, 1, 1$ ;	
	$R_2$ ;	$1$ ; $1, -1, 1$ ;
	$R_3$ ;	$1$ ; $-1, 1, 1$ ;
	$R_4$ ;	$1$ ; $-1, -1, 1$ ;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, I\mathcal{T}}$ ; $R_1$ ;	$1$ ; $1, 1, 1$ ;	
	$R_2$ ;	$1$ ; $1, -1, 1$ ;
	$R_3$ ;	$1$ ; $-1, 1, 1$ ;
	$R_4$ ;	$1$ ; $-1, -1, 1$ ;
$H$ ; YT; $\sigma_y, C_{2z, I\mathcal{T}}$ ; $R_5$ ;	$2$ ; $-\sigma_2, \sigma_3, -\sigma_0$ ;	L-NS <sub>YTSR</sub> ;
$Q$ ; SR; $\sigma_y, C_{2z, I\mathcal{T}}$ ; $\{R_5, R_5\}$ ; $4$ ; $-\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{2,2}$ ;	DNL;	0
$G$ ; XU; $C_{2z, \sigma_y, I\mathcal{T}}$ ; $\{R_1, R_3\}$ ; $2$ ; $\sigma_3, \sigma_0, \sigma_1$ ;		L-NS <sub>XUSR</sub> ;
	$\{R_2, R_4\}$ ; $2$ ; $\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>XUSR</sub> ;

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
		$R_2;$	1; -1, 1, 1, 1;	
		$R_3;$	1; 1, -1, 1, 1;	
		$R_4;$	1; -1, -1, 1, 1;	
		$R_5;$	1; 1, 1, -1, 1;	
		$R_6;$	1; -1, 1, -1, 1;	
		$R_7;$	1; 1, -1, -1, 1;	
		$R_8;$	1; -1, -1, -1, 1;	
$Y; (\bar{1}00);$	$\sigma_x, I, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
$X; (0\frac{1}{2}0);$	$\sigma_y, I, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
$Z; (00\frac{1}{2});$	$\sigma_x, I, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNL/NS;
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNL/NS;
$T; (\bar{1}20\frac{1}{2});$	$\sigma_y, C_{2z}, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNL/NS;
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNL/NS;
$S; (\bar{1}2\frac{1}{2}0);$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_0, \sigma_1;$	P-NSs;
		$\{R_{10}, R_{12}\};$	2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
		$\{R_{14}, R_{16}\};$	2; $i\sigma_3, -\sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
$R; (\bar{1}2\frac{1}{2}\frac{1}{2});$	$C_{2y}, I, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NSs;
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NSs;
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
$D; XS;$	$C_{2y}, \sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_0, \sigma_1;$	L-NS <sub>XUSR</sub> ;
		$\{R_6, R_8\};$	2; $\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>XUSR</sub> ;
$P; UR;$	$C_{2y}, \sigma_z, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_1, -i\sigma_1;$	L-NS <sub>XUSR</sub> ;
$B; ZT;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
$C; YS;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2; $-\sigma_3, \sigma_0, \sigma_1;$	L-NS <sub>YTSR</sub> ;
		$\{R_6, R_8\};$	2; $-\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>YTSR</sub> ;
$E; TR;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	2; $-\sigma_2, \sigma_1, -i\sigma_1;$	L-NS <sub>YTSR</sub> ;
$A; ZU;$	$\sigma_z, C_{2x}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	

$H$ ; YT;  $\sigma_y, C_{2z}, IT$ ;  $R_5$ ;      2;  $-\sigma_2, \sigma_3, -\sigma_0$ ; L-NS<sub>YTSR</sub>;  
 $Q$ ; SR;  $\sigma_y, C_{2z}, IT$ ;  $\{R_2, R_4\}$ ; 2;  $i\sigma_3, \sigma_0, \sigma_1$ ;    L-NSs;  
                                  $\{R_6, R_8\}$ ; 2;  $i\sigma_3, -\sigma_0, \sigma_1$ ;    L-NSs;  
 $G$ ; XU;  $\sigma_x, C_{2z}, IT$ ;  $R_5$ ;      2;  $\sigma_2, \sigma_3, -\sigma_0$ ;    L-NS<sub>XUSR</sub>;

SG 59

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; -1, 1, 1, 1;$	
	$R_3; 1; 1, -1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 1; 1, 1, -1, 1;$	
	$R_6; 1; -1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, -1, -1, 1;$	
$Y; (\bar{1}00); \sigma_z, I, \sigma_x, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
$X; (0\frac{1}{2}0); \sigma_z, I, \sigma_y, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
$Z; (00\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; -1, 1, 1, 1;$	
	$R_3; 1; 1, -1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 1; 1, 1, -1, 1;$	
	$R_6; 1; -1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, -1, -1, 1;$	
$U; (0\frac{1}{2}\frac{1}{2}); \sigma_z, I, \sigma_y, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
$T; (\bar{1}0\frac{1}{2}); \sigma_z, I, \sigma_x, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
$S; (\bar{1}\frac{1}{2}0); C_{2x}, I, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NSs;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NSs;
$R; (\bar{1}\frac{1}{2}\frac{1}{2}); C_{2x}, I, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NSs;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NSs;
$\Delta; \Gamma Y; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$D; X S; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	L-NS <sub>XUSR</sub> ;
$P; U R; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	L-NS <sub>XUSR</sub> ;
$B; Z T; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$\Sigma; \Gamma X; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$C; Y S; C_{2x}, \sigma_z, I\mathcal{T};$	$R_5; 2; -\sigma_2, i\sigma_3, -i\sigma_3;$	P-NS <sub>YTSR</sub> ;
$E; T R; C_{2x}, \sigma_z, I\mathcal{T};$	$R_5; 2; -\sigma_2, i\sigma_3, -i\sigma_3;$	P-NS <sub>YTSR</sub> ;

$A$ ; ZU; $C_{2x, \sigma_z, IT}$ ; $R_1$ ;	$1$ ; $1, 1, 1$ ;
	$R_2$ ; $1$ ; $1, -1, 1$ ;
	$R_3$ ; $1$ ; $-1, 1, 1$ ;
	$R_4$ ; $1$ ; $-1, -1, 1$ ;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $R_1$ ;	$1$ ; $1, 1, 1$ ;
	$R_2$ ; $1$ ; $1, -1, 1$ ;
	$R_3$ ; $1$ ; $-1, 1, 1$ ;
	$R_4$ ; $1$ ; $-1, -1, 1$ ;
$H$ ; YT; $C_{2z, \sigma_y, IT}$ ; $\{R_1, R_4\}$ ; $2$ ; $\sigma_3, \sigma_3, \sigma_1$ ;	P-NS <sub>YTSR</sub> ;
	$\{R_2, R_3\}$ ; $2$ ; $\sigma_3, -\sigma_3, \sigma_1$ ; P-NS <sub>YTSR</sub> ;
$Q$ ; SR; $C_{2z, \sigma_y, IT}$ ; $\{R_1, R_2\}$ ; $2$ ; $\sigma_0, \sigma_3, \sigma_1$ ;	L-NSs;
	$\{R_3, R_4\}$ ; $2$ ; $-\sigma_0, \sigma_3, \sigma_1$ ; L-NSs;
$G$ ; XU; $C_{2z, \sigma_y, IT}$ ; $\{R_1, R_3\}$ ; $2$ ; $\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>XUSR</sub> ;
	$\{R_2, R_4\}$ ; $2$ ; $\sigma_3, -\sigma_0, \sigma_1$ ; L-NS <sub>XUSR</sub> ;



SG 60

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}0\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; -1, 1, 1, 1;	
	$R_3;$	1; 1, -1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	1; 1, 1, -1, 1;	
	$R_6;$	1; -1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, -1, -1, 1;	
$Y; (\bar{1}00); \sigma_z, I, \sigma_x, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>YTSR</sub> ;
$X; (0\frac{1}{2}0); \sigma_y, I, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>XUSR</sub> ;
$Z; (00\frac{1}{2}); \sigma_x, I, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;
$U; (0\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2z}, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNL/NS;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNL/NS;
$T; (\bar{1}0\frac{1}{2}); \sigma_y, C_{2z}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	DP; 0
$S; (\bar{1}\frac{1}{2}0); C_{2y}, C_{2z}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	P-DNL <sub>SR</sub> ;
$R; (\bar{1}\frac{1}{2}\frac{1}{2}); C_{2x}, C_{2z}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	P-DNL <sub>SR</sub> ;
$\Delta; \Gamma Y; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$D; XS; C_{2y}, \sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_0, \sigma_1;$	L-NS <sub>XUSR</sub> ;
	$\{R_6, R_8\};$	2; $\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>XUSR</sub> ;
$P; UR; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2; $\sigma_2, -i\sigma_1, -i\sigma_3;$	L-NS <sub>XUSR</sub> ;
$B; ZT; \sigma_z, C_{2y}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$
$\Sigma; \Gamma X; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$C; YS; C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	2; $-\sigma_2, i\sigma_3, -i\sigma_3;$	L-NS <sub>YTSR</sub> ;
$E; TR; C_{2x}, \sigma_y, I\mathcal{T};$	$\{R_2, R_8\};$	2; $-\sigma_3, -i\sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
	$\{R_4, R_6\};$	2; $\sigma_3, -i\sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
$A; ZU; \sigma_z, C_{2x}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$H; YT; C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_1, R_4\};$	2; $\sigma_3, \sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
	$\{R_2, R_3\};$	2; $\sigma_3, -\sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;
$Q; SR; \sigma_x, C_{2z}, I\mathcal{T};$	$\{R_5, R_5\};$	4; $\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{2,2};$	DNL; 0
$G; XU; \sigma_x, C_{2z}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -\sigma_0;$	L-NS <sub>XUSR</sub> ;

## 8. SG 61-70

SG 61

 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; (000); $C_{2z}, C_{2y}, I, \mathcal{T}$ ; $R_1$ ;	$R_1$ ;	1; 1, 1, 1, 1;	
	$R_2$ ;	1; -1, 1, 1, 1;	
	$R_3$ ;	1; 1, -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1, 1;	
	$R_5$ ;	1; 1, 1, -1, 1;	
	$R_6$ ;	1; -1, 1, -1, 1;	
	$R_7$ ;	1; 1, -1, -1, 1;	
	$R_8$ ;	1; -1, -1, -1, 1;	
$Y$ ; ( $\frac{1}{2}00$ ); $\sigma_z, I, \sigma_x, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NS <sub>YTSR</sub> ;
	$R_{10}$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NS <sub>YTSR</sub> ;
$X$ ; ( $0\frac{1}{2}0$ ); $\sigma_y, I, \sigma_z, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NS <sub>XUSR</sub> ;
	$R_{10}$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NS <sub>XUSR</sub> ;
$Z$ ; ( $00\frac{1}{2}$ ); $\sigma_x, I, \sigma_y, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NS <sub>ZUTR</sub> ;
	$R_{10}$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NS <sub>ZUTR</sub> ;
$U$ ; ( $0\frac{1}{2}\frac{1}{2}$ ); $C_{2x}, C_{2y}, I, \mathcal{T}$ ; $\{R_9, R_{10}\}$ ;	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0}$ ;	P-DNL <sub>UR</sub> ;	
$T$ ; ( $\frac{1}{2}0\frac{1}{2}$ ); $C_{2z}, C_{2x}, I, \mathcal{T}$ ; $\{R_9, R_{10}\}$ ;	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0}$ ;	P-DNL <sub>TR</sub> ;	
$S$ ; ( $\frac{1}{2}\frac{1}{2}0$ ); $C_{2y}, C_{2z}, I, \mathcal{T}$ ; $\{R_9, R_{10}\}$ ;	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0}$ ;	P-DNL <sub>SR</sub> ;	
$R$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $C_{2x}, C_{2y}, I, \mathcal{T}$ ; $\{R_5, R_5\}$ ;	4; $i\Gamma_{0,2}, i\Gamma_{0,1}, \Gamma_{0,0}, -\Gamma_{2,2}$ ;	P-DNL <sub>S</sub> ;	
	$\{R_{10}, R_{10}\}$ ;	4; $i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{0,0}, -\Gamma_{2,2}$ ;	P-DNL <sub>S</sub> ;
$\Delta$ ; $\Gamma Y$ ; $C_{2y}, \sigma_x, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
$D$ ; XS; $C_{2y}, \sigma_z, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>XUSR</sub> ;
	$\{R_6, R_8\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>XUSR</sub> ;
$P$ ; UR; $C_{2y}, \sigma_x, I, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	4; $\Gamma_{0,2}, -i\Gamma_{0,1}, -\Gamma_{2,2}$ ;	DNL; 0
$B$ ; ZT; $\sigma_z, C_{2y}, I, \mathcal{T}$ ;	$R_5$ ;	2; $\sigma_2, \sigma_3, -\sigma_0$ ;	L-NS <sub>ZUTR</sub> ;
$\Sigma$ ; $\Gamma X$ ; $C_{2x}, \sigma_z, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
$C$ ; YS; $\sigma_y, C_{2x}, I, \mathcal{T}$ ;	$R_5$ ;	2; $-\sigma_2, \sigma_3, -\sigma_0$ ;	L-NS <sub>YTSR</sub> ;
$E$ ; TR; $C_{2x}, \sigma_z, I, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	4; $\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,2}$ ;	DNL; 0
$A$ ; ZU; $C_{2x}, \sigma_y, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;
	$\{R_6, R_8\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
$H$ ; YT; $C_{2z}, \sigma_x, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $-\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;
	$\{R_6, R_8\}$ ;	2; $-\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;
$Q$ ; SR; $C_{2z}, \sigma_y, I, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	4; $-\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,2}$ ;	DNL; 0
$G$ ; XU; $\sigma_x, C_{2z}, I, \mathcal{T}$ ;	$R_5$ ;	2; $\sigma_2, \sigma_3, -\sigma_0$ ;	L-NS <sub>XUSR</sub> ;

$\Gamma_o$ ;  $\{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; (000); $C_{2z}, C_{2y}, I, \mathcal{T}$ ; $R_1$ ;		$1$ ; $1, 1, 1, 1$ ;	
	$R_2$ ;	$1$ ; $-1, 1, 1, 1$ ;	
	$R_3$ ;	$1$ ; $1, -1, 1, 1$ ;	
	$R_4$ ;	$1$ ; $-1, -1, 1, 1$ ;	
	$R_5$ ;	$1$ ; $1, 1, -1, 1$ ;	
	$R_6$ ;	$1$ ; $-1, 1, -1, 1$ ;	
	$R_7$ ;	$1$ ; $1, -1, -1, 1$ ;	
	$R_8$ ;	$1$ ; $-1, -1, -1, 1$ ;	
$Y$ ; ( $\bar{1}00$ ); $\sigma_x, I, \sigma_z, \mathcal{T}$ ;	$R_5$ ;	$2$ ; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NS <sub>YTSR</sub> ;
	$R_{10}$ ;	$2$ ; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NS <sub>YTSR</sub> ;
$X$ ; ( $0\frac{1}{2}0$ ); $\sigma_z, I, \sigma_y, \mathcal{T}$ ;	$R_5$ ;	$2$ ; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NS <sub>XUSR</sub> ;
	$R_{10}$ ;	$2$ ; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NS <sub>XUSR</sub> ;
$Z$ ; ( $00\frac{1}{2}$ ); $\sigma_x, I, \sigma_y, \mathcal{T}$ ;	$R_5$ ;	$2$ ; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NS <sub>ZUTR</sub> ;
	$R_{10}$ ;	$2$ ; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NS <sub>ZUTR</sub> ;
$U$ ; ( $0\frac{1}{2}\frac{1}{2}$ ); $C_{2x}, C_{2y}, I, \mathcal{T}$ ; $\{R_2, R_4\}$ ;	$2$ ; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1$ ;	P-NSs;	
	$\{R_6, R_8\}$ ;	$2$ ; $i\sigma_3, -\sigma_0, \sigma_0, \sigma_1$ ;	P-NSs;
	$\{R_{10}, R_{12}\}$ ;	$2$ ; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_1$ ;	P-NSs;
	$\{R_{14}, R_{16}\}$ ;	$2$ ; $i\sigma_3, -\sigma_0, -\sigma_0, \sigma_1$ ;	P-NSs;
$T$ ; ( $\bar{1}0\frac{1}{2}$ ); $C_{2y}, I, C_{2x}, \mathcal{T}$ ;	$R_5$ ;	$2$ ; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NSs;
	$R_{10}$ ;	$2$ ; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NSs;
$S$ ; ( $\bar{1}\frac{1}{2}0$ ); $C_{2x}, \sigma_y, I, \mathcal{T}$ ;	$\{R_9, R_{10}\}$ ;	$4$ ; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0}$ ;	P-DNL <sub>SR</sub> ;
$R$ ; ( $\bar{1}\frac{1}{2}\frac{1}{2}$ ); $\sigma_z, \sigma_y, I, \mathcal{T}$ ;	$\{R_9, R_{10}\}$ ;	$4$ ; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0}$ ;	P-DNL <sub>SR</sub> ;
$\Delta$ ; $\Gamma Y$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$R_1$ ;	$1$ ; $1, 1, 1$ ;	
	$R_2$ ;	$1$ ; $1, -1, 1$ ;	
	$R_3$ ;	$1$ ; $-1, 1, 1$ ;	
	$R_4$ ;	$1$ ; $-1, -1, 1$ ;	
$D$ ; XS; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$R_5$ ;	$2$ ; $\sigma_2, \sigma_3, -i\sigma_1$ ;	L-NS <sub>XUSR</sub> ;
$P$ ; UR; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$\{R_2, R_6\}$ ;	$2$ ; $\sigma_0, -i\sigma_3, \sigma_1$ ;	L-NSs;
	$\{R_4, R_8\}$ ;	$2$ ; $-\sigma_0, -i\sigma_3, \sigma_1$ ;	L-NSs;
$B$ ; ZT; $\sigma_z, C_{2y}, I\mathcal{T}$ ;	$R_5$ ;	$2$ ; $\sigma_2, \sigma_3, -\sigma_0$ ;	L-NS <sub>ZUTR</sub> ;
$\Sigma$ ; $\Gamma X$ ; $C_{2x}, \sigma_z, I\mathcal{T}$ ;	$R_1$ ;	$1$ ; $1, 1, 1$ ;	
	$R_2$ ;	$1$ ; $1, -1, 1$ ;	
	$R_3$ ;	$1$ ; $-1, 1, 1$ ;	
	$R_4$ ;	$1$ ; $-1, -1, 1$ ;	
$C$ ; YS; $C_{2x}, \sigma_z, I\mathcal{T}$ ;	$\{R_1, R_3\}$ ;	$2$ ; $\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;
	$\{R_2, R_4\}$ ;	$2$ ; $\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>YTSR</sub> ;
$E$ ; TR; $C_{2x}, \sigma_y, I\mathcal{T}$ ;	$\{R_2, R_6\}$ ;	$2$ ; $\sigma_0, \sigma_3, \sigma_1$ ;	L-NSs;
	$\{R_4, R_8\}$ ;	$2$ ; $-\sigma_0, \sigma_3, \sigma_1$ ;	L-NSs;
$A$ ; ZU; $C_{2x}, \sigma_y, I\mathcal{T}$ ;	$\{R_2, R_4\}$ ;	$2$ ; $\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;
	$\{R_6, R_8\}$ ;	$2$ ; $\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, I\mathcal{T}$ ;	$R_1$ ;	$1$ ; $1, 1, 1$ ;	
	$R_2$ ;	$1$ ; $1, -1, 1$ ;	
	$R_3$ ;	$1$ ; $-1, 1, 1$ ;	
	$R_4$ ;	$1$ ; $-1, -1, 1$ ;	

$$\begin{aligned} H; & \text{YT}; C_{2z,\sigma_y,IT}; R_5; & 2; & -\sigma_2, \sigma_3, -i\sigma_1; & \text{L-NS}_{YTSR}; \\ Q; & \text{SR}; C_{2z,\sigma_y,IT}; \{R_5, R_5\}; & 4; & -\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{2,2}; & \text{DNL}; & 0 \\ G; & \text{XU}; C_{2z,\sigma_y,IT}; \{R_1, R_3\}; & 2; & \sigma_3, \sigma_0, \sigma_1; & \text{L-NS}_{XUSR}; \\ & & & \{R_2, R_4\}; & 2; & \sigma_3, -\sigma_0, \sigma_1; & \text{L-NS}_{XUSR}; \end{aligned}$$

SG 63

 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; -1, 1, 1, 1;$	
	$R_3; 1; 1, -1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 1; 1, 1, -1, 1;$	
	$R_6; 1; -1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, -1, -1, 1;$	
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; -1, 1, 1, 1;$	
	$R_3; 1; 1, -1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 1; 1, 1, -1, 1;$	
	$R_6; 1; -1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, -1, -1, 1;$	
$Z; (00\frac{1}{2}); C_{2z}, I, \sigma_x, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>ZTR</sub> ;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>ZTR</sub> ;
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2z}, I, \sigma_x, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>ZTR</sub> ;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>ZTR</sub> ;
$S; (0\frac{1}{2}0); C_{2z}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ZTR</sub> ;
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$H; Y\Gamma; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$D; S\Gamma; C_{2z}, I\mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$A; Z\Gamma; \sigma_z, C_{2x}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -\sigma_0;$	L-NS <sub>ZTR</sub> ;
$\Sigma; \Gamma Y; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$\Delta; \Gamma\Delta; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	

$$\begin{aligned}
B; \text{ ZB}; \ C_{2y, \sigma_x, I\mathcal{T}}; \ \{R_2, R_4\}; \ 2; \ \sigma_3, \sigma_0, \sigma_1; \ \text{L-NS}_{ZTR}; \\
\{R_6, R_8\}; \ 2; \ \sigma_3, -\sigma_0, \sigma_1; \ \text{L-NS}_{ZTR}; \\
G; \text{ TG}; \ C_{2y, \sigma_x, I\mathcal{T}}; \ \{R_2, R_4\}; \ 2; \ \sigma_3, \sigma_0, \sigma_1; \ \text{L-NS}_{ZTR}; \\
\{R_6, R_8\}; \ 2; \ \sigma_3, -\sigma_0, \sigma_1; \ \text{L-NS}_{ZTR}; \\
F; \text{ YF}; \ C_{2y, \sigma_x, I\mathcal{T}}; \ R_1; \quad 1; \ 1, 1, 1; \\
R_2; \quad 1; \ 1, -1, 1; \\
R_3; \quad 1; \ -1, 1, 1; \\
R_4; \quad 1; \ -1, -1, 1; \\
E; \text{ TE}; \ \sigma_z, C_{2x, I\mathcal{T}}; \ R_5; \quad 2; \ \sigma_2, \sigma_3, -\sigma_0; \ \text{L-NS}_{ZTR}; \\
C; \text{ YC}; \ C_{2x, \sigma_z, I\mathcal{T}}; \ R_1; \quad 1; \ 1, 1, 1; \\
R_2; \quad 1; \ 1, -1, 1; \\
R_3; \quad 1; \ -1, 1, 1; \\
R_4; \quad 1; \ -1, -1, 1;
\end{aligned}$$

SG 64

 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; -1, 1, 1, 1;		
	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; -1, 1, 1, 1;		
	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
$Z; (00\frac{1}{2}); C_{2z}, I, \sigma_x, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>ZTR</sub> ;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>ZTR</sub> ;	
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2z}, I, \sigma_x, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS <sub>ZTR</sub> ;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS <sub>ZTR</sub> ;	
$S; (0\frac{1}{2}0); \sigma_z, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNL <sub>SR</sub> ;	
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_z, I, \mathcal{T};$	{ $R_2, R_4$ }; 2; $i\sigma_3, \sigma_0, \sigma_1;$		P-WNL/NS;	
	{ $R_6, R_8$ }; 2; $i\sigma_3, -\sigma_0, \sigma_1;$		P-WNL/NS;	
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$H; Y\Gamma; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, -1, 1;		
	$R_2;$	1; 1, 1, 1;		
	$R_3;$	1; -1, -1, 1;		
	$R_4;$	1; -1, 1, 1;		
$D; \text{SR}; C_{2z}, I\mathcal{T};$	{ $R_1, R_2$ }; 2; $\sigma_3, \sigma_1;$		WNL;	$\pi$
$A; Z\Gamma; \sigma_z, C_{2x}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -\sigma_0;$	L-NS <sub>ZTR</sub> ;	
$\Sigma; \Gamma Y; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Delta; \Gamma\Delta; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$B; ZB; C_{2y}, \sigma_x, I\mathcal{T};$	{ $R_2, R_4$ }; 2; $\sigma_3, \sigma_0, \sigma_1;$		L-NS <sub>ZTR</sub> ;	
	{ $R_6, R_8$ }; 2; $\sigma_3, -\sigma_0, \sigma_1;$		L-NS <sub>ZTR</sub> ;	
$G; T\Gamma; C_{2y}, \sigma_x, I\mathcal{T};$	{ $R_2, R_4$ }; 2; $\sigma_3, -\sigma_0, \sigma_1;$		L-NS <sub>ZTR</sub> ;	
	{ $R_6, R_8$ }; 2; $\sigma_3, \sigma_0, \sigma_1;$		L-NS <sub>ZTR</sub> ;	

$F$ ; YF;  $C_{2y,\sigma_x,IT}$ ;  $R_1$ ; 1; 1, -1, 1;  
 $R_2$ ; 1; 1, 1, 1;  
 $R_3$ ; 1; -1, -1, 1;  
 $R_4$ ; 1; -1, 1, 1;  
 $E$ ; TE;  $\sigma_z, C_{2x,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -\sigma_0$ ; L-NS $_{ZTR}$ ;  
 $C$ ; YC;  $C_{2x,\sigma_z,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;



SG 65

 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$

$Y; (\frac{1}{2}\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$

$Z; (00\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$

$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T}; R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; -1, 1, 1, 1;$   
 $R_3; 1; 1, -1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 1; 1, 1, -1, 1;$   
 $R_6; 1; -1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, -1, -1, 1;$

$S; (0\frac{1}{2}0); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$\Lambda; \Gamma Z; C_{2z}, \sigma_y, I, \mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

$$\begin{aligned}
H; \text{ YT}; C_{2z, \sigma_y, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
D; \text{ SR}; C_{2z, I\mathcal{T}}; R_1; 1; 1, 1; \\
R_2; 1; -1, 1; \\
A; \text{ ZT}; C_{2x, \sigma_z, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
\Sigma; \text{ \Gamma Y}; C_{2x, \sigma_z, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
\Delta; \text{ \Gamma \Delta}; C_{2y, \sigma_x, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
B; \text{ ZB}; C_{2y, \sigma_x, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
G; \text{ TG}; C_{2y, \sigma_x, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
F; \text{ YF}; C_{2y, \sigma_x, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
E; \text{ TE}; C_{2x, \sigma_z, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
C; \text{ YC}; C_{2x, \sigma_z, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1;
\end{aligned}$$

SG 66

 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; -1, 1, 1, 1;$	
	$R_3; 1; 1, -1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 1; 1, 1, -1, 1;$	
	$R_6; 1; -1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, -1, -1, 1;$	
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; -1, 1, 1, 1;$	
	$R_3; 1; 1, -1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 1; 1, 1, -1, 1;$	
	$R_6; 1; -1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, -1, -1, 1;$	
$Z; (00\frac{1}{2}); \sigma_x, I, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); \sigma_x, I, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;
$S; (0\frac{1}{2}0); C_{2z}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$H; Y\Gamma; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$D; SR; C_{2z}, I\mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$A; Z\Gamma; \sigma_z, C_{2x}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$
	$\Sigma; \Gamma Y; C_{2x}, \sigma_z, I\mathcal{T};$	
	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$\Delta; \Gamma\Delta; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	

$B$ ; ZB;  $\sigma_z, C_{2y}, I\mathcal{T}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $G$ ; TG;  $\sigma_z, C_{2y}, I\mathcal{T}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $F$ ; YF;  $C_{2y}, \sigma_x, I\mathcal{T}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $E$ ; TE;  $\sigma_z, C_{2x}, I\mathcal{T}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $C$ ; YC;  $C_{2x}, \sigma_z, I\mathcal{T}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;

SG 67

 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; -1, 1, 1, 1;	
	$R_3;$	1; 1, -1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	1; 1, 1, -1, 1;	
	$R_6;$	1; -1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, -1, -1, 1;	
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; -1, 1, 1, 1;	
	$R_3;$	1; 1, -1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	1; 1, 1, -1, 1;	
	$R_6;$	1; -1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, -1, -1, 1;	
$Z; (00\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; -1, 1, 1, 1;	
	$R_3;$	1; 1, -1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	1; 1, 1, -1, 1;	
	$R_6;$	1; -1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, -1, -1, 1;	
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; -1, 1, 1, 1;	
	$R_3;$	1; 1, -1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	1; 1, 1, -1, 1;	
	$R_6;$	1; -1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, -1, -1, 1;	
$S; (0\frac{1}{2}0); \sigma_z, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_z, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$H; YT; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, -1, 1;	
	$R_2;$	1; 1, 1, 1;	
	$R_3;$	1; -1, -1, 1;	
	$R_4;$	1; -1, 1, 1;	
$D; SR; C_{2z}, I\mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	WNL; $\pi$
$A; ZT; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	

$$\begin{aligned}
&\Sigma; \Gamma Y; C_{2x, \sigma_z, IT}; R_1; 1; 1, 1, 1; \\
&\quad R_2; 1; 1, -1, 1; \\
&\quad R_3; 1; -1, 1, 1; \\
&\quad R_4; 1; -1, -1, 1; \\
&\Delta; \Gamma \Delta; C_{2y, \sigma_x, IT}; R_1; 1; 1, 1, 1; \\
&\quad R_2; 1; 1, -1, 1; \\
&\quad R_3; 1; -1, 1, 1; \\
&\quad R_4; 1; -1, -1, 1; \\
&B; ZB; C_{2y, \sigma_x, IT}; R_1; 1; 1, 1, 1; \\
&\quad R_2; 1; 1, -1, 1; \\
&\quad R_3; 1; -1, 1, 1; \\
&\quad R_4; 1; -1, -1, 1; \\
&G; TG; C_{2y, \sigma_x, IT}; R_1; 1; 1, -1, 1; \\
&\quad R_2; 1; 1, 1, 1; \\
&\quad R_3; 1; -1, -1, 1; \\
&\quad R_4; 1; -1, 1, 1; \\
&F; YF; C_{2y, \sigma_x, IT}; R_1; 1; 1, -1, 1; \\
&\quad R_2; 1; 1, 1, 1; \\
&\quad R_3; 1; -1, -1, 1; \\
&\quad R_4; 1; -1, 1, 1; \\
&E; TE; C_{2x, \sigma_z, IT}; R_1; 1; 1, 1, 1; \\
&\quad R_2; 1; 1, -1, 1; \\
&\quad R_3; 1; -1, 1, 1; \\
&\quad R_4; 1; -1, -1, 1; \\
&C; YC; C_{2x, \sigma_z, IT}; R_1; 1; 1, 1, 1; \\
&\quad R_2; 1; 1, -1, 1; \\
&\quad R_3; 1; -1, 1, 1; \\
&\quad R_4; 1; -1, -1, 1;
\end{aligned}$$

SG 68

 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; -1, 1, 1, 1;		
	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
$Y; (\frac{1}{2}\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; -1, 1, 1, 1;		
	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
$Z; (00\frac{1}{2}); \sigma_x, I, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); \sigma_x, I, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$S; (0\frac{1}{2}0); \sigma_z, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_z, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$H; YT; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, -1, 1;		
	$R_2;$	1; 1, 1, 1;		
	$R_3;$	1; -1, -1, 1;		
	$R_4;$	1; -1, 1, 1;		
$D; SR; C_{2z}, I\mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$A; ZT; \sigma_z, C_{2x}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma Y; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Delta; \Gamma\Delta; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$B; ZB; \sigma_z, C_{2y}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$G; TG; \sigma_z, C_{2y}, I\mathcal{T};$	$R_5;$	2; $-\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$F; YF; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, -1, 1;		
	$R_2;$	1; 1, 1, 1;		
	$R_3;$	1; -1, -1, 1;		
	$R_4;$	1; -1, 1, 1;		

$E$ ; TE;  $\sigma_z, C_{2x}, I\mathcal{T}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $C$ ; YC;  $C_{2x}, \sigma_z, I\mathcal{T}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;



SG 69

 $\Gamma_o^f; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$
		$R_2; 1; -1, 1, 1, 1;$
		$R_3; 1; 1, -1, 1, 1;$
		$R_4; 1; -1, -1, 1, 1;$
		$R_5; 1; 1, 1, -1, 1;$
		$R_6; 1; -1, 1, -1, 1;$
		$R_7; 1; 1, -1, -1, 1;$
		$R_8; 1; -1, -1, -1, 1;$
$Y; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$
		$R_2; 1; -1, 1, 1, 1;$
		$R_3; 1; 1, -1, 1, 1;$
		$R_4; 1; -1, -1, 1, 1;$
		$R_5; 1; 1, 1, -1, 1;$
		$R_6; 1; -1, 1, -1, 1;$
		$R_7; 1; 1, -1, -1, 1;$
		$R_8; 1; -1, -1, -1, 1;$
$X; (\frac{1}{2}0\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$
		$R_2; 1; -1, 1, 1, 1;$
		$R_3; 1; 1, -1, 1, 1;$
		$R_4; 1; -1, -1, 1, 1;$
		$R_5; 1; 1, 1, -1, 1;$
		$R_6; 1; -1, 1, -1, 1;$
		$R_7; 1; 1, -1, -1, 1;$
		$R_8; 1; -1, -1, -1, 1;$
$Z; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$
		$R_2; 1; -1, 1, 1, 1;$
		$R_3; 1; 1, -1, 1, 1;$
		$R_4; 1; -1, -1, 1, 1;$
		$R_5; 1; 1, 1, -1, 1;$
		$R_6; 1; -1, 1, -1, 1;$
		$R_7; 1; 1, -1, -1, 1;$
		$R_8; 1; -1, -1, -1, 1;$
$L; (\frac{1}{2}00);$	$I, \mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$
$\Lambda; \Gamma Z/\Gamma \Lambda;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$G; XG/XY;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$H; YH/YX;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$

$$\begin{aligned}
Q; ZQ; \quad & C_{2z, \sigma_y, IT}; R_1; 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 1; -1, 1, 1; \\
& R_4; 1; -1, -1, 1; \\
\Sigma; \Gamma X/\Gamma \Sigma; \quad & C_{2x, \sigma_z, IT}; R_1; 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 1; -1, 1, 1; \\
& R_4; 1; -1, -1, 1; \\
C; YC/YZ; \quad & C_{2x, \sigma_z, IT}; R_1; 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 1; -1, 1, 1; \\
& R_4; 1; -1, -1, 1; \\
A; ZA/ZY; \quad & C_{2x, \sigma_z, IT}; R_1; 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 1; -1, 1, 1; \\
& R_4; 1; -1, -1, 1; \\
U; XU; \quad & C_{2x, \sigma_z, IT}; R_1; 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 1; -1, 1, 1; \\
& R_4; 1; -1, -1, 1; \\
\Delta; \Gamma Y/\Gamma \Delta; \quad & C_{2y, \sigma_x, IT}; R_1; 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 1; -1, 1, 1; \\
& R_4; 1; -1, -1, 1; \\
D; XD/XZ; \quad & C_{2y, \sigma_x, IT}; R_1; 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 1; -1, 1, 1; \\
& R_4; 1; -1, -1, 1; \\
B; ZB/ZX; \quad & C_{2y, \sigma_x, IT}; R_1; 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 1; -1, 1, 1; \\
& R_4; 1; -1, -1, 1; \\
R; YR; \quad & C_{2y, \sigma_x, IT}; R_1; 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 1; -1, 1, 1; \\
& R_4; 1; -1, -1, 1;
\end{aligned}$$

SG 70

 $\Gamma_o^f; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$		
		$R_2; 1; -1, 1, 1, 1;$		
		$R_3; 1; 1, -1, 1, 1;$		
		$R_4; 1; -1, -1, 1, 1;$		
		$R_5; 1; 1, 1, -1, 1;$		
		$R_6; 1; -1, 1, -1, 1;$		
		$R_7; 1; 1, -1, -1, 1;$		
		$R_8; 1; -1, -1, -1, 1;$		
$Y; (0\frac{1}{2}\frac{1}{2});$	$\sigma_x, I, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
		$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$X; (\frac{1}{2}0\frac{1}{2});$	$\sigma_z, I, C_{2x}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
		$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$Z; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_y, I, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
		$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$L; (\frac{1}{2}00);$	$I, \mathcal{T};$	$R_1; 1; 1, 1;$		
		$R_2; 1; -1, 1;$		
$\Lambda; \Gamma Z/\Gamma \Lambda;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$		
		$R_2; 1; 1, -1, 1;$		
		$R_3; 1; -1, 1, 1;$		
		$R_4; 1; -1, -1, 1;$		
$G; XG/XY;$	$\sigma_x, C_{2z}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$H; YH/YX;$	$\sigma_y, C_{2z}, I\mathcal{T};$	$R_5; 2; -\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$Q; ZQ;$	$\sigma_x, C_{2z}, I\mathcal{T};$	$R_2; 1; i, 1, 1;$		
		$R_4; 1; -i, 1, 1;$		
		$R_6; 1; i, -1, 1;$		
		$R_8; 1; -i, -1, 1;$		
$\Sigma; \Gamma X/\Gamma \Sigma;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$		
		$R_2; 1; 1, -1, 1;$		
		$R_3; 1; -1, 1, 1;$		
		$R_4; 1; -1, -1, 1;$		
$C; YC/YZ;$	$\sigma_y, C_{2x}, I\mathcal{T};$	$R_5; 2; -\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$A; ZA/ZY;$	$\sigma_z, C_{2x}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$U; XU;$	$\sigma_y, C_{2x}, I\mathcal{T};$	$R_2; 1; i, 1, 1;$		
		$R_4; 1; -i, 1, 1;$		
		$R_6; 1; i, -1, 1;$		
		$R_8; 1; -i, -1, 1;$		
$\Delta; \Gamma Y/\Gamma \Delta;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$		
		$R_2; 1; 1, -1, 1;$		
		$R_3; 1; -1, 1, 1;$		
		$R_4; 1; -1, -1, 1;$		
$D; XD/XZ;$	$\sigma_x, C_{2y}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$B; ZB/ZX;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$R; YR;$	$\sigma_x, C_{2y}, I\mathcal{T};$	$R_2; 1; -i, 1, 1;$		
		$R_4; 1; i, 1, 1;$		
		$R_6; 1; -i, -1, 1;$		
		$R_8; 1; i, -1, 1;$		

SG 71

 $\Gamma_o^v; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$
		$R_2; 1; -1, 1, 1, 1;$
		$R_3; 1; 1, -1, 1, 1;$
		$R_4; 1; -1, -1, 1, 1;$
		$R_5; 1; 1, 1, -1, 1;$
		$R_6; 1; -1, 1, -1, 1;$
		$R_7; 1; 1, -1, -1, 1;$
		$R_8; 1; -1, -1, -1, 1;$
$X; (\frac{1}{2}\bar{1}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$
		$R_2; 1; -1, 1, 1, 1;$
		$R_3; 1; 1, -1, 1, 1;$
		$R_4; 1; -1, -1, 1, 1;$
		$R_5; 1; 1, 1, -1, 1;$
		$R_6; 1; -1, 1, -1, 1;$
		$R_7; 1; 1, -1, -1, 1;$
		$R_8; 1; -1, -1, -1, 1;$
$R; (\frac{1}{2}00);$	$C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$S; (\frac{1}{2}0\bar{1}\frac{1}{2});$	$C_{2x}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$T; (\frac{1}{2}\bar{1}0);$	$C_{2z}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$W; (\frac{3}{4}\bar{1}\frac{1}{4});$	$C_{2z}, C_{2y}, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$\Lambda; \Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$G; XG;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$P; TW;$	$C_{2z}, I\mathcal{T};$	$R_1; 1; 1, 1;$
		$R_2; 1; -1, 1;$

$$\begin{aligned}
& \Sigma; \Gamma\Sigma/\Gamma X; C_{2x,\sigma_z,IT}; R_1; 1; 1, 1, 1; \\
& \quad R_2; 1; 1, -1, 1; \\
& \quad R_3; 1; -1, 1, 1; \\
& \quad R_4; 1; -1, -1, 1; \\
& F; XF; C_{2x,\sigma_z,IT}; R_1; 1; 1, 1, 1; \\
& \quad R_2; 1; 1, -1, 1; \\
& \quad R_3; 1; -1, 1, 1; \\
& \quad R_4; 1; -1, -1, 1; \\
& D; SW; C_{2x,IT}; R_1; 1; 1, 1; \\
& \quad R_2; 1; -1, 1; \\
& \Delta; \Gamma\Delta/\Gamma X; C_{2y,\sigma_x,IT}; R_1; 1; 1, 1, 1; \\
& \quad R_2; 1; 1, -1, 1; \\
& \quad R_3; 1; -1, 1, 1; \\
& \quad R_4; 1; -1, -1, 1; \\
& U; XU; C_{2y,\sigma_x,IT}; R_1; 1; 1, 1, 1; \\
& \quad R_2; 1; 1, -1, 1; \\
& \quad R_3; 1; -1, 1, 1; \\
& \quad R_4; 1; -1, -1, 1; \\
& Q; RW; C_{2y,IT}; R_1; 1; 1, 1; \\
& \quad R_2; 1; -1, 1;
\end{aligned}$$

SG 72

 $\Gamma_o^v; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
		$R_2;$	1; -1, 1, 1, 1;	
		$R_3;$	1; 1, -1, 1, 1;	
		$R_4;$	1; -1, -1, 1, 1;	
		$R_5;$	1; 1, 1, -1, 1;	
		$R_6;$	1; -1, 1, -1, 1;	
		$R_7;$	1; 1, -1, -1, 1;	
		$R_8;$	1; -1, -1, -1, 1;	
$X; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
		$R_2;$	1; -1, 1, 1, 1;	
		$R_3;$	1; 1, -1, 1, 1;	
		$R_4;$	1; -1, -1, 1, 1;	
		$R_5;$	1; 1, 1, -1, 1;	
		$R_6;$	1; -1, 1, -1, 1;	
		$R_7;$	1; 1, -1, -1, 1;	
		$R_8;$	1; -1, -1, -1, 1;	
$R; (\frac{1}{2}00);$	$\sigma_y, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;
$S; (\frac{1}{2}0\frac{1}{2});$	$\sigma_x, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;
$T; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
$W; (\frac{3}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_0, \sigma_3, \sigma_1;$	P-WNLs;
		$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, \sigma_1;$	P-WNLs;
$\Lambda; \Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
$G; XG;$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
$P; TW;$	$C_{2z}, I, \mathcal{T};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
$\Sigma; \Gamma\Sigma/\Gamma X;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
$F; XF;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
$D; SW;$	$C_{2x}, I, \mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	WNL; $\pi$

$\Delta$ ; $\Gamma\Delta/\Gamma X$ ; $C_{2y,\sigma_x,IT}$ ; $R_1$ ;	$R_1$ ;	1; 1, 1, 1;
	$R_2$ ;	1; 1, -1, 1;
	$R_3$ ;	1; -1, 1, 1;
	$R_4$ ;	1; -1, -1, 1;
$U$ ; XU; $C_{2y,\sigma_x,IT}$ ; $R_1$ ;	$R_1$ ;	1; 1, 1, 1;
	$R_2$ ;	1; 1, -1, 1;
	$R_3$ ;	1; -1, 1, 1;
	$R_4$ ;	1; -1, -1, 1;
$Q$ ; RW; $C_{2y,IT}$ ;	$\{R_1, R_2\}$ ; 2; $\sigma_3, \sigma_1$ ;	WNL; $\pi$

SG 73

 $\Gamma_o^v; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
		$R_2;$	1; -1, 1, 1, 1;		
		$R_3;$	1; 1, -1, 1, 1;		
		$R_4;$	1; -1, -1, 1, 1;		
		$R_5;$	1; 1, 1, -1, 1;		
		$R_6;$	1; -1, 1, -1, 1;		
		$R_7;$	1; 1, -1, -1, 1;		
		$R_8;$	1; -1, -1, -1, 1;		
$X; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
		$R_2;$	1; -1, 1, 1, 1;		
		$R_3;$	1; 1, -1, 1, 1;		
		$R_4;$	1; -1, -1, 1, 1;		
		$R_5;$	1; 1, 1, -1, 1;		
		$R_6;$	1; -1, 1, -1, 1;		
		$R_7;$	1; 1, -1, -1, 1;		
		$R_8;$	1; -1, -1, -1, 1;		
$R; (\frac{1}{2}00);$	$\sigma_y, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$S; (\frac{1}{2}0\frac{1}{2});$	$\sigma_x, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$T; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_z, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$W; (\frac{3}{4}\frac{1}{4}\frac{1}{4});$	$E, C_{2z}, C_{2y}, I\mathcal{T};$	$\{R_9, R_9\};$	4; $i\Gamma_{0,0}, \Gamma_{0,1}, \Gamma_{0,3}, -\Gamma_{2,2};$	DP;	0
$\Lambda; \Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$G; XG;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; -1, 1, 1;		
		$R_2;$	1; -1, -1, 1;		
		$R_3;$	1; 1, 1, 1;		
		$R_4;$	1; 1, -1, 1;		
$P; TW;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma\Sigma/\Gamma X;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$F; XF;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; -1, 1, 1;		
		$R_2;$	1; -1, -1, 1;		
		$R_3;$	1; 1, 1, 1;		
		$R_4;$	1; 1, -1, 1;		
$D; SW;$	$C_{2x}, I\mathcal{T};$	$\{R_2, R_4\};$	2; $-\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Delta; \Gamma\Delta/\Gamma X;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$U; XU;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$Q; RW;$	$C_{2y}, I\mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$



SG 74

 $\Gamma_o^v; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
		$R_2;$	1; -1, 1, 1, 1;		
		$R_3;$	1; 1, -1, 1, 1;		
		$R_4;$	1; -1, -1, 1, 1;		
		$R_5;$	1; 1, 1, -1, 1;		
		$R_6;$	1; -1, 1, -1, 1;		
		$R_7;$	1; 1, -1, -1, 1;		
		$R_8;$	1; -1, -1, -1, 1;		
$X; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
		$R_2;$	1; -1, 1, 1, 1;		
		$R_3;$	1; 1, -1, 1, 1;		
		$R_4;$	1; -1, -1, 1, 1;		
		$R_5;$	1; 1, 1, -1, 1;		
		$R_6;$	1; -1, 1, -1, 1;		
		$R_7;$	1; 1, -1, -1, 1;		
		$R_8;$	1; -1, -1, -1, 1;		
$R; (\frac{1}{2}00);$	$C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$S; (\frac{1}{2}0\frac{1}{2});$	$C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$T; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_z, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$W; (\frac{3}{4}\frac{1}{4}\frac{1}{4});$	$E, C_{2z}, C_{2y}, I, \mathcal{T};$	$R_9;$	2; $i\sigma_0, \sigma_1, \sigma_3, -i\sigma_3;$	P-WNL <sub>TW</sub> ;	
$\Lambda; \Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$G; XG;$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$R_1;$	1; -1, 1, 1;		
		$R_2;$	1; -1, -1, 1;		
		$R_3;$	1; 1, 1, 1;		
		$R_4;$	1; 1, -1, 1;		
$P; TW;$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma\Sigma/\Gamma X;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$F; XF;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_1;$	1; -1, -1, 1;		
		$R_2;$	1; -1, 1, 1;		
		$R_3;$	1; 1, -1, 1;		
		$R_4;$	1; 1, 1, 1;		
$D; SW;$	$C_{2x}, I, \mathcal{T};$	$R_2;$	1; -1, 1;		
		$R_4;$	1; 1, 1;		

$$\begin{array}{lll} \Delta; \Gamma\Delta/\Gamma X; C_{2y,\sigma_x,IT}; & R_1; & 1; 1, 1, 1; \\ & R_2; & 1; 1, -1, 1; \\ & R_3; & 1; -1, 1, 1; \\ & R_4; & 1; -1, -1, 1; \\ U; XU; & C_{2y,\sigma_x,IT}; & R_1; 1; 1, -1, 1; \\ & & R_2; 1; 1, 1, 1; \\ & & R_3; 1; -1, -1, 1; \\ & & R_4; 1; -1, 1, 1; \\ Q; RW; & C_{2y,IT}; & R_2; 1; 1, 1; \\ & & R_4; 1; -1, 1; \end{array}$$

SG 75

 $\Gamma_q; \{C_{4z}^+|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$ (000); $C_{4z}^+; \mathcal{T};$	$R_1;$	1; 1, 1;
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1$ ; C-2 WP; 2
$M;$ ( $\frac{1}{2}\frac{1}{2}0$ ); $C_{4z}^+; \mathcal{T};$	$R_3;$	1; -1, 1;
	$R_1;$	1; 1, 1;
$Z;$ ( $00\frac{1}{2}$ ); $C_{4z}^+; \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1$ ; C-2 WP; 2
	$R_3;$	1; -1, 1;
$A;$ ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $C_{4z}^+; \mathcal{T};$	$R_1;$	1; 1, 1;
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1$ ; C-2 WP; 2
$R;$ ( $0\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $C_{2z}; \mathcal{T};$	$R_3;$	1; -1, 1;
	$R_1;$	1; 1, 1;
$X;$ ( $0\frac{1}{2}0$ ); $C_{2z}; \mathcal{T};$	$R_2;$	1; -1, 1;
	$R_1;$	1; 1, 1;
$\Delta;$ $\Gamma X;$ $E, \mathcal{T}C_{2z};$	$R_2;$	1; -1, 1;
	$R_1;$	1; 1, 1;
$U;$ $ZR;$ $E, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;
	$R_1;$	1; 1, 1;
$\Lambda;$ $\Gamma Z;$ $C_{4z}^+;$	$R_1;$	1; 1;
	$R_2;$	1; $i$ ;
$V;$ $MA;$ $C_{4z}^+;$	$R_3;$	1; -1;
	$R_4;$	1; $-i$ ;
$\Sigma;$ $\Gamma M;$ $E, \mathcal{T}C_{2z};$	$R_1;$	1; 1;
	$R_2;$	1; $i$ ;
$S;$ $ZA;$ $E, \mathcal{T}C_{2z};$	$R_3;$	1; -1;
	$R_4;$	1; $-i$ ;
$Y;$ $XM;$ $E, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;
	$R_1;$	1; 1, 1;
$T;$ $RA;$ $E, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;
	$R_1;$	1; 1, 1;
$W;$ $XR;$ $C_{2z};$	$R_1;$	1; 1;
	$R_2;$	1; -1;

SG 76

 $\Gamma_q; \{C_{4z}^+ | 00\frac{1}{4}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_{4z}^+; \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	C-2 WP; 2
			$R_3;$	$1; -1, 1;$	
$M;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+; \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	C-2 WP; 2
			$R_3;$	$1; -1, 1;$	
$Z;$	$(00\frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_1;$	P-NS <sub>ZAR</sub> ;
			$\{R_4, R_6\};$	$2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_1;$	P-NS <sub>ZAR</sub> ;
$A;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_1;$	P-NS <sub>ZAR</sub> ;
			$\{R_4, R_6\};$	$2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_1;$	P-NS <sub>ZAR</sub> ;
$R;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{2z}; \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	P-NS <sub>ZAR</sub> ;
$X;$	$(0\frac{1}{2}0);$	$C_{2z}; \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$R_2;$	$1; -1, 1;$	
$\Delta;$	$\Gamma X;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	
$U;$	$ZR;$	$E, \mathcal{T}C_{2z};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;
$\Lambda;$	$\Gamma Z;$	$C_{4z}^+;$	$R_1;$	$1; 1;$	
			$R_2;$	$1; i;$	
			$R_3;$	$1; -1;$	
			$R_4;$	$1; -i;$	
$V;$	$MA;$	$C_{4z}^+;$	$R_1;$	$1; 1;$	
			$R_2;$	$1; i;$	
			$R_3;$	$1; -1;$	
			$R_4;$	$1; -i;$	
$\Sigma;$	$\Gamma M;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	
$S;$	$ZA;$	$E, \mathcal{T}C_{2z};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;
$Y;$	$XM;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	
$T;$	$RA;$	$E, \mathcal{T}C_{2z};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;
$W;$	$XR;$	$C_{2z};$	$R_1;$	$1; 1;$	
			$R_2;$	$1; -1;$	

SG 77

 $\Gamma_q; \{C_{4z}^+ | 00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$ (000); $C_{4z}^+; \mathcal{T};$	$R_1;$	1; 1, 1;
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1$ ; C-2 WP; 2
$M;$ ( $\frac{1}{2}\frac{1}{2}0$ ); $C_{4z}^+; \mathcal{T};$	$R_3;$	1; -1, 1;
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1$ ; C-2 WP; 2
$Z;$ ( $00\frac{1}{2}$ ); $C_{4z}^+; \mathcal{T};$	$R_1;$	1; 1, 1;
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1$ ; C-2 WP; 2
$A;$ ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $C_{4z}^+; \mathcal{T};$	$R_3;$	1; -1, 1;
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1$ ; C-2 WP; 2
$R;$ ( $0\frac{1}{2}\frac{1}{2}$ ); $C_{2z}; \mathcal{T};$	$R_1;$	1; 1, 1;
	$R_2;$	1; -1, 1;
$X;$ ( $0\frac{1}{2}0$ ); $C_{2z}; \mathcal{T};$	$R_1;$	1; 1, 1;
	$R_2;$	1; -1, 1;
$\Delta;$ $\Gamma X;$	$E, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;
$U;$ $ZR;$	$E, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;
$\Lambda;$ $\Gamma Z;$	$C_{4z}^+;$	$R_1;$ 1; 1;
	$R_2;$	1; $i$ ;
	$R_3;$	1; -1;
	$R_4;$	1; $-i$ ;
$V;$ $MA;$	$C_{4z}^+;$	$R_1;$ 1; 1;
	$R_2;$	1; $i$ ;
	$R_3;$	1; -1;
	$R_4;$	1; $-i$ ;
$\Sigma;$ $\Gamma M;$	$E, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;
$S;$ $ZA;$	$E, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;
$Y;$ $XM;$	$E, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;
$T;$ $RA;$	$E, \mathcal{T}C_{2z}; R_1;$	1; 1, 1;
$W;$ $XR;$	$C_{2z};$	$R_1;$ 1; 1;
	$R_2;$	1; -1;

SG 78

 $\Gamma_q; \{C_{4z}^+ | 00 \frac{3}{4}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+; \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	C-2 WP; 2
	$R_3;$	$1; -1, 1;$	
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+; \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	C-2 WP; 2
	$R_3;$	$1; -1, 1;$	
$Z; (00 \frac{1}{2}); C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_1;$	P-NS <sub>ZAR</sub> ;
	$\{R_4, R_6\};$	$2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_1;$	P-NS <sub>ZAR</sub> ;
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_1;$	P-NS <sub>ZAR</sub> ;
	$\{R_4, R_6\};$	$2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_1;$	P-NS <sub>ZAR</sub> ;
$R; (0 \frac{1}{2} \frac{1}{2}); C_{2z}; \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	P-NS <sub>ZAR</sub> ;
$X; (0 \frac{1}{2} 0); C_{2z}; \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$R_2;$	$1; -1, 1;$	
$\Delta; \Gamma X; E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	
$U; ZR; E, \mathcal{T}C_{2z};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;
$\Lambda; \Gamma Z; C_{4z}^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; i;$	
	$R_3;$	$1; -1;$	
	$R_4;$	$1; -i;$	
$V; MA; C_{4z}^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; i;$	
	$R_3;$	$1; -1;$	
	$R_4;$	$1; -i;$	
$\Sigma; \Gamma M; E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	
$S; ZA; E, \mathcal{T}C_{2z};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;
$Y; XM; E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	
$T; RA; E, \mathcal{T}C_{2z};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;
$W; XR; C_{2z};$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	

SG 79

 $\Gamma_q^v; \{C_{4z}^+|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_{4z}^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	C-2 WP; 2
			$R_3;$	$1; -1, 1;$	
$N;$	$(0\frac{1}{2}0);$	$E, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$X;$	$(00\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$R_2;$	$1; -1, 1;$	
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	C-2 WP; 2
			$R_3;$	$1; -1, 1;$	
$P;$	$(\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, C_{4z}^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	C-2 WP; 2
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_{4z}^+;$	$R_1;$	$1; 1;$	
			$R_2;$	$1; i;$	
			$R_3;$	$1; -1;$	
			$R_4;$	$1; -i;$	
$V;$	$ZV;$	$C_{4z}^+;$	$R_1;$	$1; 1;$	
			$R_2;$	$1; i;$	
			$R_3;$	$1; -1;$	
			$R_4;$	$1; -i;$	
$W;$	$XP;$	$C_{2z};$	$R_1;$	$1; 1;$	
			$R_2;$	$1; -1;$	
$\Sigma;$	$\Gamma Z/\Gamma\Sigma;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	
$F;$	$ZF;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	
$Q;$	$NP;$	$E;$	$R_1;$	$1; 1;$	
$\Delta;$	$\Gamma X;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	
$U;$	$ZU;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	
$Y;$	$XZ/XY;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$	

SG 80

 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000);$	$C_{4z}^+; \mathcal{T};$	$R_1;$	$1; 1, 1;$	
		$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	C-2 WP; 2
		$R_3;$	$1; -1, 1;$	
$N; (0\frac{1}{2}0);$	$E, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$X; (00\frac{1}{2});$	$C_{2z}; \mathcal{T};$	$R_1;$	$1; 1, 1;$	
		$R_2;$	$1; -1, 1;$	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$R_1;$	$1; 1, 1;$	
		$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	C-2 WP; 2
		$R_3;$	$1; -1, 1;$	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, C_{4z}^+ \mathcal{T};$	$\{R_1, R_2\};$	$2; \sigma_3, e^{-\frac{i\pi}{4} \frac{(\sigma_1 + \sigma_2)}{\sqrt{2}}};$	C-1 WP; 1
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+;$	$R_1;$	$1; 1;$	
		$R_2;$	$1; i;$	
		$R_3;$	$1; -1;$	
		$R_4;$	$1; -i;$	
$V; ZV;$	$C_{4z}^+; E;$	$R_5;$	$1; 1, 1;$	
		$R_6;$	$1; i, 1;$	
		$R_7;$	$1; -1, 1;$	
		$R_8;$	$1; -i, 1;$	
$W; XP;$	$C_{2z};$	$R_1;$	$1; 1;$	
		$R_2;$	$1; -1;$	
$\Sigma; \Gamma Z/\Gamma \Sigma;$	$E, \mathcal{T} C_{2z};$	$R_1;$	$1; 1, 1;$	
$F; ZF;$	$E, \mathcal{T} C_{2z};$	$R_1;$	$1; 1, 1;$	
$Q; NP;$	$E;$	$R_1;$	$1; 1;$	
$\Delta; \Gamma X;$	$E, \mathcal{T} C_{2z};$	$R_1;$	$1; 1, 1;$	
$U; ZU;$	$E, \mathcal{T} C_{2z};$	$R_1;$	$1; 1, 1;$	
$Y; XZ/XY;$	$E, \mathcal{T} C_{2z};$	$R_1;$	$1; 1, 1;$	



SG 81

 $\Gamma_q; \{S_{4z}^+|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$\Gamma$ ; (000); $S_{4z}^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;		
	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	P-QNL $_{\Gamma Z}$ ;	
	$R_3$ ;	1; -1, 1;		
$M$ ; ( $\frac{1}{2}\frac{1}{2}0$ ); $S_{4z}^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;		
	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	P-QNL $_{MA}$ ;	
	$R_3$ ;	1; -1, 1;		
$Z$ ; ( $00\frac{1}{2}$ ); $S_{4z}^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;		
	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	P-QNL $_{\Gamma Z}$ ;	
	$R_3$ ;	1; -1, 1;		
$A$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $S_{4z}^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;		
	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	P-QNL $_{MA}$ ;	
	$R_3$ ;	1; -1, 1;		
$R$ ; ( $0\frac{1}{2}\frac{1}{2}$ ); $C_{2z}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;		
	$R_2$ ;	1; -1, 1;		
$X$ ; ( $0\frac{1}{2}0$ ); $C_{2z}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;		
	$R_2$ ;	1; -1, 1;		
$\Delta$ ; $\Gamma X$ ;	$E, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;	
$U$ ; $ZR$ ;	$E, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;	
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}, S_{4z}^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
	$\{R_2, R_2\}$ ;	2; $-\sigma_0, -i\sigma_2$ ;	QNL;	0
$V$ ; $MA$ ;	$C_{2z}, S_{4z}^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
	$\{R_2, R_2\}$ ;	2; $-\sigma_0, -i\sigma_2$ ;	QNL;	0
$\Sigma$ ; $\Gamma M$ ;	$E, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;	
$S$ ; $ZA$ ;	$E, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;	
$Y$ ; $XM$ ;	$E, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;	
$T$ ; $RA$ ;	$E, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;	
$W$ ; $XR$ ;	$C_{2z}$ ;	$R_1$ ;	1; 1;	
		$R_2$ ;	1; -1;	

SG 82

 $\Gamma_q^v; \{S_{4z}^+|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$S_{4z}^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
		$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	P-QNL $_{\Gamma Z};$	
		$R_3;$	$1; -1, 1;$		
$N; (0\frac{1}{2}0);$	$E, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
$X; (00\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
		$R_2;$	$1; -1, 1;$		
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_{4z}^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
		$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	P-QNL $_{\Gamma Z};$	
		$R_3;$	$1; -1, 1;$		
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+;$	$R_1;$	$1; 1;$		
		$R_2;$	$1; i;$		
		$R_3;$	$1; -1;$		
		$R_4;$	$1; -i;$		
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{2z}, S_{4z}^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
		$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	QNL;	0
$V; ZV;$	$C_{2z}, S_{4z}^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
		$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	QNL;	0
$W; XP;$	$C_{2z};$	$R_1;$	$1; 1;$		
		$R_2;$	$1; -1;$		
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$		
$F; ZF;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$		
$Q; NP;$	$E;$	$R_1;$	$1; 1;$		
$\Delta; \Gamma X;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$		
$U; ZU;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$		
$Y; XZ/XY;$	$E, \mathcal{T}C_{2z};$	$R_1;$	$1; 1, 1;$		

SG 83

 $\Gamma_q; \{C_{4z}^+|000\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; $(000)$ ; $C_{4z}^+, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;		
	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_0, \sigma_1$ ;	P-QNL $_{\Gamma Z}$ ;	
	$R_3$ ;	1; -1, 1, 1;		
	$R_5$ ;	1; 1, -1, 1;		
	$\{R_6, R_8\}$ ;	2; $i\sigma_3, -\sigma_0, \sigma_1$ ;	P-QNL $_{\Gamma Z}$ ;	
	$R_7$ ;	1; -1, -1, 1;		
	$M$ ; $(\frac{1}{2}\frac{1}{2}0)$ ; $C_{4z}^+, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_0, \sigma_1$ ;	P-QNL $_{MA}$ ;	
	$R_3$ ;	1; -1, 1, 1;		
	$R_5$ ;	1; 1, -1, 1;		
	$\{R_6, R_8\}$ ;	2; $i\sigma_3, -\sigma_0, \sigma_1$ ;	P-QNL $_{MA}$ ;	
	$R_7$ ;	1; -1, -1, 1;		
$Z$ ; $(00\frac{1}{2})$ ; $C_{4z}^+, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;		
	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_0, \sigma_1$ ;	P-QNL $_{\Gamma Z}$ ;	
	$R_3$ ;	1; -1, 1, 1;		
	$R_5$ ;	1; 1, -1, 1;		
	$\{R_6, R_8\}$ ;	2; $i\sigma_3, -\sigma_0, \sigma_1$ ;	P-QNL $_{\Gamma Z}$ ;	
	$R_7$ ;	1; -1, -1, 1;		
$A$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $C_{4z}^+, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;		
	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_0, \sigma_1$ ;	P-QNL $_{MA}$ ;	
	$R_3$ ;	1; -1, 1, 1;		
	$R_5$ ;	1; 1, -1, 1;		
	$\{R_6, R_8\}$ ;	2; $i\sigma_3, -\sigma_0, \sigma_1$ ;	P-QNL $_{MA}$ ;	
	$R_7$ ;	1; -1, -1, 1;		
$R$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_{2z}, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;		
	$R_2$ ;	1; 1, -1, 1;		
	$R_3$ ;	1; -1, 1, 1;		
	$R_4$ ;	1; -1, -1, 1;		
	$X$ ; $(0\frac{1}{2}0)$ ; $C_{2z}, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;		
	$R_3$ ;	1; -1, 1, 1;		
	$R_4$ ;	1; -1, -1, 1;		
$\Delta$ ; $\Gamma X$ ;	$\sigma_z, I\mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$U$ ; $ZR$ ;	$\sigma_z, I\mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$\Lambda$ ; $\Gamma Z$ ;	$C_{4z}^+, I\mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	QNL; 0
		$R_3$ ;	1; -1, 1;	
$V$ ; $MA$ ;	$C_{4z}^+, I\mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	QNL; 0
		$R_3$ ;	1; -1, 1;	

$$\begin{aligned} \Sigma; \Gamma\text{M}; \sigma_z, I\mathcal{T}; \quad & R_1; 1; 1, 1; \\ & R_2; 1; -1, 1; \\ S; \text{ZA}; \sigma_z, I\mathcal{T}; \quad & R_1; 1; 1, 1; \\ & R_2; 1; -1, 1; \\ Y; \text{XM}; \sigma_z, I\mathcal{T}; \quad & R_1; 1; 1, 1; \\ & R_2; 1; -1, 1; \\ T; \text{RA}; \sigma_z, I\mathcal{T}; \quad & R_1; 1; 1, 1; \\ & R_2; 1; -1, 1; \\ W; \text{XR}; C_{2z}, I\mathcal{T}; \quad & R_1; 1; 1, 1; \\ & R_2; 1; -1, 1; \end{aligned}$$

SG 84

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-QNL $_{\Gamma Z};$	
	$R_3;$	1; -1, 1, 1;		
	$R_5;$	1; 1, -1, 1;		
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, I, \mathcal{T};$	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-QNL $_{\Gamma Z};$	
	$R_7;$	1; -1, -1, 1;		
	$R_1;$	1; 1, 1, 1;		
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-QNL $_{MA};$	
$Z; (00\frac{1}{2}); C_{4z}^+, E, I, \mathcal{T};$	$R_3;$	1; -1, 1, 1;		
	$R_5;$	1; 1, -1, 1;		
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-QNL $_{MA};$	
	$R_7;$	1; -1, -1, 1;		
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, E, I, \mathcal{T};$	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T};$	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0); C_{2z}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Delta; \Gamma X; \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$U; ZR; \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Lambda; \Gamma Z; C_{4z}^+, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	QNL;	0
	$R_3;$	1; -1, 1;		
	$R_5;$	1; 1, 1;		
$V; MA; C_{4z}^+, I\mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	QNL;	0
	$R_3;$	1; -1, 1;		
	$R_1;$	1; 1, 1;		
	$R_5;$	1; -1, 1;		
$\Sigma; \Gamma M; \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
	$R_3;$	1; 1, 1;		
	$R_4;$	1; -1, 1;		
$S; ZA; \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
	$R_3;$	1; 1, 1;		
	$R_4;$	1; -1, 1;		
$Y; XM; \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
	$R_3;$	1; 1, 1;		
	$R_4;$	1; -1, 1;		
$T; RA; \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
	$R_3;$	1; 1, 1;		
	$R_4;$	1; -1, 1;		
$W; XR; C_{2z}, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		

SG 85

 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-QNL $_{\Gamma Z};$	
	$R_3;$	1; -1, 1, 1;		
	$R_5;$	1; 1, -1, 1;		
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, E, I, \mathcal{T};$	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (00 \frac{1}{2}); C_{4z}^+, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-QNL $_{\Gamma Z};$	
	$R_3;$	1; -1, 1, 1;		
	$R_5;$	1; 1, -1, 1;		
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-QNL $_{\Gamma Z};$	
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, E, I, \mathcal{T};$	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (0 \frac{1}{2} \frac{1}{2}); \sigma_z, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0 \frac{1}{2} 0); \sigma_z, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma X; \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U; ZR; \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Lambda; \Gamma Z; C_{4z}^+, I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	QNL;	0
	$R_3;$	1; -1, 1;		
$V; MA; C_{4z}^+, E, I, \mathcal{T};$	$\{R_5, R_7\};$	2; $-\sigma_3, \sigma_0, \sigma_1;$	QNL;	0
	$R_6;$	1; $-i, 1, 1;$		
	$R_8;$	1; $i, 1, 1;$		
$\Sigma; \Gamma M; \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; ZA; \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$Y; XM; \sigma_z, I, \mathcal{T};$	$R_1;$	1; $-i, 1;$		
	$R_2;$	1; $i, 1;$		
$T; RA; \sigma_z, I, \mathcal{T};$	$R_1;$	1; $-i, 1;$		
	$R_2;$	1; $i, 1;$		
$W; XR; C_{2z}, I, \mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$

SG 86

 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, \sigma_1;$	P-QNL $_{\Gamma Z};$	
	$R_3;$	$1; -1, 1, 1;$		
	$R_5;$	$1; 1, -1, 1;$		
	$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, \sigma_1;$	P-QNL $_{\Gamma Z};$	
	$R_7;$	$1; -1, -1, 1;$		
	$R_{10};$	$2; i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, E, I, \mathcal{T};$	$R_9;$	$2; \sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
	$R_{10};$	$2; i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (00 \frac{1}{2}); C_{4z}^+, E, I, \mathcal{T};$	$R_9;$	$2; \sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
	$R_{10};$	$2; i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, \sigma_1;$	P-QNL $_{MA};$	
	$R_3;$	$1; -1, 1, 1;$		
	$R_5;$	$1; 1, -1, 1;$		
	$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, \sigma_1;$	P-QNL $_{MA};$	
	$R_7;$	$1; -1, -1, 1;$		
	$R_{10};$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (0 \frac{1}{2} \frac{1}{2}); \sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0 \frac{1}{2} 0); \sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma X; \sigma_z, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$U; ZR; \sigma_z, I, \mathcal{T};$	$R_2;$	$1; 1, 1;$		
	$R_4;$	$1; -1, 1;$		
	$R_{10};$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Lambda; \Gamma Z; C_{4z}^+, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	QNL;	0
	$R_3;$	$1; -1, 1;$		
$V; MA; C_{4z}^+, E, I, \mathcal{T};$	$\{R_5, R_7\};$	$2; -\sigma_3, \sigma_0, \sigma_1;$	QNL;	0
	$R_6;$	$1; -i, 1, 1;$		
	$R_8;$	$1; i, 1, 1;$		
	$R_{10};$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Sigma; \Gamma M; \sigma_z, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$S; ZA; \sigma_z, I, \mathcal{T};$	$R_2;$	$1; 1, 1;$		
	$R_4;$	$1; -1, 1;$		
$Y; XM; \sigma_z, I, \mathcal{T};$	$R_1;$	$1; -i, 1;$		
	$R_2;$	$1; i, 1;$		
$T; RA; \sigma_z, I, \mathcal{T};$	$R_2;$	$1; -i, 1;$		
	$R_4;$	$1; i, 1;$		
$W; XR; C_{2z}, I, \mathcal{T};$	$\{R_1, R_2\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$

SG 87

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; (000);	$C_{4z}^+, I, \mathcal{T}$ ; $R_1$ ;	1; 1, 1, 1;		
		$\{R_2, R_4\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_1$ ;	P-QNL $_{\Gamma Z}$ ;	
		$R_3$ ;	1; -1, 1, 1;	
		$R_5$ ;	1; 1, -1, 1;	
		$\{R_6, R_8\}$ ; 2; $i\sigma_3, -\sigma_0, \sigma_1$ ;	P-QNL $_{\Gamma Z}$ ;	
		$R_7$ ;	1; -1, -1, 1;	
$N$ ; (0 $\frac{1}{2}$ 0);	$I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$X$ ; (00 $\frac{1}{2}$ );	$C_{2z}, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
		$R_2$ ;	1; 1, -1, 1;	
		$R_3$ ;	1; -1, 1, 1;	
		$R_4$ ;	1; -1, -1, 1;	
$Z$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{4z}^+, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
		$\{R_2, R_4\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_1$ ;	P-QNL $_{\Gamma Z}$ ;	
		$R_3$ ;	1; -1, 1, 1;	
		$R_5$ ;	1; 1, -1, 1;	
		$\{R_6, R_8\}$ ; 2; $i\sigma_3, -\sigma_0, \sigma_1$ ;	P-QNL $_{\Gamma Z}$ ;	
$P$ ; ( $\frac{1}{4}\frac{1}{4}\frac{1}{4}$ );	$S_{4z}^+, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$\{R_2, R_4\}$ ; 2; $i\sigma_3, \sigma_1$ ;	P-WNL;	
		$R_3$ ;	1; -1, 1;	
$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$\{R_2, R_4\}$ ; 2; $i\sigma_3, \sigma_1$ ;	QNL;	0
		$R_3$ ;	1; -1, 1;	
$V$ ; ZV;	$C_{4z}^+, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$\{R_2, R_4\}$ ; 2; $i\sigma_3, \sigma_1$ ;	QNL;	0
		$R_3$ ;	1; -1, 1;	
$W$ ; XP;	$C_{2z}, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$\sigma_z, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$F$ ; ZF;	$\sigma_z, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$Q$ ; NP;	$E, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
$\Delta$ ; $\Gamma X$ ;	$\sigma_z, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$U$ ; ZU;	$\sigma_z, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$Y$ ; XZ/XY;	$\sigma_z, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	



SG 88

 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{I | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{4z}^+, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
		$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, \sigma_1;$	P-QNL $_{\Gamma Z};$	
		$R_3;$	$1; -1, 1, 1;$		
		$R_5;$	$1; 1, -1, 1;$		
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, \sigma_1;$	P-QNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
		$R_2;$	$1; -1, 1;$		
$X; (00\frac{1}{2});$	$\sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, E, I, \mathcal{T};$	$R_9;$	$2; \sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
		$R_{10};$	$2; i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, I, \mathcal{T};$	$\{R_1, R_4\};$	$2; (\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_1;$	P-WNL $_{XP};$	
		$\{R_2, R_3\};$	$2; (-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_1;$	P-WNL $_{XP};$	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
		$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	QNL;	0
		$R_3;$	$1; -1, 1;$		
$V; ZV;$	$C_{4z}^+, E, I, \mathcal{T};$	$\{R_5, R_7\};$	$2; \sigma_3, \sigma_0, \sigma_1;$	QNL;	0
		$R_6;$	$1; i, 1, 1;$		
		$R_8;$	$1; -i, 1, 1;$		
$W; XP;$	$C_{2z}, I, \mathcal{T};$	$\{R_1, R_2\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\sigma_z, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
		$R_2;$	$1; -1, 1;$		
$F; ZF;$	$\sigma_z, I, \mathcal{T};$	$R_2;$	$1; 1, 1;$		
		$R_4;$	$1; -1, 1;$		
$Q; NP;$	$E, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
$\Delta; \Gamma X;$	$\sigma_z, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
		$R_2;$	$1; -1, 1;$		
$U; ZU;$	$\sigma_z, I, \mathcal{T};$	$R_2;$	$1; 1, 1;$		
		$R_4;$	$1; -1, 1;$		
$Y; XZ/XY;$	$\sigma_z, I, \mathcal{T};$	$R_1;$	$1; -i, 1;$		
		$R_2;$	$1; i, 1;$		

SG 89

 $\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

- $\Gamma$ ;  $(000)$ ;  $C_{4z}^+, C_{2x}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $R_5$ ; 2;  $i\sigma_2, \sigma_3, -\sigma_0$ ; C-2 WP; 2  
 $M$ ;  $(\frac{1}{2}\frac{1}{2}0)$ ;  $C_{4z}^+, C_{2x}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $R_5$ ; 2;  $i\sigma_2, \sigma_3, -\sigma_0$ ; C-2 WP; 2  
 $Z$ ;  $(00\frac{1}{2})$ ;  $C_{4z}^+, C_{2x}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $R_5$ ; 2;  $i\sigma_2, \sigma_3, -\sigma_0$ ; C-2 WP; 2  
 $A$ ;  $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;  $C_{4z}^+, C_{2x}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $R_5$ ; 2;  $i\sigma_2, \sigma_3, -\sigma_0$ ; C-2 WP; 2  
 $R$ ;  $(0\frac{1}{2}\frac{1}{2})$ ;  $C_{2z}, C_{2y}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $X$ ;  $(0\frac{1}{2}0)$ ;  $C_{2z}, C_{2y}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $\Delta$ ;  $\Gamma X$ ;  $C_{2y}, \mathcal{T}C_{2z}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;  
 $U$ ;  $ZR$ ;  $C_{2y}, \mathcal{T}C_{2z}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{4z}^+, C_{2b}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1;  $i$ , 1;  
 $R_3$ ; 1; -1, 1;  
 $R_4$ ; 1;  $-i$ , 1;  
 $V$ ;  $MA$ ;  $C_{4z}^+, C_{2b}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1;  $i$ , 1;  
 $R_3$ ; 1; -1, 1;  
 $R_4$ ; 1;  $-i$ , 1;  
 $\Sigma$ ;  $\Gamma M$ ;  $C_{2a}, C_{2b}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;  
 $S$ ;  $ZA$ ;  $C_{2a}, C_{2b}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;

$Y$ ; XM;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;  
 $T$ ; RA;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;  
 $W$ ; XR;  $C_{2z}, \mathcal{T}C_{2y}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;

SG 90

$\Gamma_q$ ;  $\{C_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$\Gamma$ ; (000); $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	C-2 WP; 2
$M$ ; ( $\frac{1}{2}\frac{1}{2}0$ ); $C_{4z}^+, C_{2z}, C_{2b}, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1$ ;	P-NSs;
	$\{R_7, R_8\}$ ;	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1$ ;	P-NSs;
	$R_9$ ;	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0$ ;	P-NSs;
$Z$ ; ( $00\frac{1}{2}$ ); $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	C-2 WP; 2
$A$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $C_{4z}^+, C_{2z}, C_{2b}, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1$ ;	P-NSs;
	$\{R_7, R_8\}$ ;	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1$ ;	P-NSs;
	$R_9$ ;	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0$ ;	P-NSs;
$R$ ; ( $0\frac{1}{2}\frac{1}{2}$ ); $C_{2y}, C_{2x}, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-NS <sub>MARX</sub> ;
$X$ ; ( $0\frac{1}{2}0$ ); $C_{2y}, C_{2x}, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-NS <sub>MARX</sub> ;
$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;	
	$R_2$ ;	1; -1, 1;	
$U$ ; ZR; $C_{2y}, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;	
	$R_2$ ;	1; -1, 1;	
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
	$R_2$ ;	1; $i, 1$ ;	
	$R_3$ ;	1; -1, 1;	
	$R_4$ ;	1; $-i, 1$ ;	
$V$ ; MA; $C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$\{R_1, R_3\}$ ;	2; $\sigma_3, \sigma_1$ ;	L-NSs;
	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	L-NSs;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
	$R_2$ ;	1; -1, 1;	
$S$ ; ZA; $C_{2a}, C_{2b}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
	$R_2$ ;	1; -1, 1;	
$Y$ ; XM; $C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_2, R_4\}$ ;	2; $\sigma_3, -i\sigma_2$ ;	L-NS <sub>MARX</sub> ;
$T$ ; RA; $C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_2, R_4\}$ ;	2; $\sigma_3, -i\sigma_2$ ;	L-NS <sub>MARX</sub> ;
$W$ ; XR; $C_{2z}, \mathcal{T}C_{2y}$ ;	$\{R_1, R_2\}$ ;	2; $\sigma_3, -i\sigma_2$ ;	L-NS <sub>MARX</sub> ;

SG 91

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{4}\}, \{C_{2x}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$Z; (00\frac{1}{2}); C_{4z}^+, C_{2x}, \mathcal{T}; R_6;$	$R_6;$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
	$R_7;$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2x}, \mathcal{T}; R_6;$	$R_6;$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
	$R_7;$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2x}, \mathcal{T}; R_5;$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$U; ZR; C_{2y}, \mathcal{T}C_{2z}; \{R_2, R_4\};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;
$\Lambda; \Gamma Z; C_{4z}^+, C_{2b}\mathcal{T}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $i, 1;$	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; $-i, 1;$	
$V; MA; C_{4z}^+, C_{2b}\mathcal{T}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $i, 1;$	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; $-i, 1;$	
$\Sigma; \Gamma M; C_{2a}, C_{2b}\mathcal{T}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S; ZA; C_{2a}, C_{2b}\mathcal{T}; \{R_2, R_6\};$	$\{R_2, R_6\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ZAR</sub> ;
$Y; XM; C_{2x}, \mathcal{T}C_{2y}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$T; RA; C_{2x}, \mathcal{T}C_{2y}; \{R_1, R_2\};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ZAR</sub> ;
$W; XR; C_{2z}, \mathcal{T}C_{2y}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	

SG 92

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{4}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_{4z}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2z}, C_{2b}, \mathcal{T}; \{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$		P-NSs;
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-NSs;
$Z; (00\frac{1}{2}); C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	2; $\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
	$R_7;$	2; $-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2a}, \mathcal{T};$	$\{R_6, R_7\};$	4; $\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, \Gamma_{1,0};$	C-2 DP;
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2x}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NSs;
$X; (0\frac{1}{2}0); C_{2y}, C_{2x}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>MARX</sub>
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$U; ZR; C_{2y}, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;
$\Lambda; \Gamma Z; C_{4z}^+, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $i, 1;$	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; $-i, 1;$	
$V; MA; C_{4z}^+, C_{2b}, \mathcal{T};$	$\{R_1, R_3\};$	2; $\sigma_3, \sigma_1;$	L-NSs;
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	L-NSs;
$\Sigma; \Gamma M; C_{2a}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S; ZA; C_{2a}, C_{2b}, \mathcal{T};$	$\{R_2, R_6\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ZAR</sub> ;
$Y; XM; C_{2x}, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>MARX</sub> ;
$T; RA; C_{2x}, \mathcal{T}C_{2y};$	$\{R_2, R_2\};$	2; $\sigma_0, -i\sigma_2;$	L-NSs;
	$\{R_4, R_4\};$	2; $-\sigma_0, -i\sigma_2;$	L-NSs;
$W; XR; C_{2z}, \mathcal{T}C_{2y};$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>MARX</sub> ;

SG 93

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{C_{2x}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$Z; (00\frac{1}{2}); C_{4z}^+, C_{2x}, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	C-2 WP; 2
	$R_6; 1; 1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, 1, -1, 1;$	
	$R_9; 1; -1, -1, -1, 1;$	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2x}, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	C-2 WP; 2
	$R_6; 1; 1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, 1, -1, 1;$	
	$R_9; 1; -1, -1, -1, 1;$	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$U; ZR; C_{2y}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$\Lambda; \Gamma Z; C_{4z}^+, C_{2b} \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; i, 1;$	
	$R_3; 1; -1, 1;$	
	$R_4; 1; -i, 1;$	
$V; MA; C_{4z}^+, C_{2b} \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; i, 1;$	
	$R_3; 1; -1, 1;$	
	$R_4; 1; -i, 1;$	
$\Sigma; \Gamma M; C_{2a}, C_{2b} \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$S; ZA; C_{2a}, C_{2b} \mathcal{T};$	$R_2; 1; 1, 1;$	
	$R_4; 1; -1, 1;$	

$Y$ ; XM;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;  
 $T$ ; RA;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;  
 $W$ ; XR;  $C_{2z}, \mathcal{T}C_{2y}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;

SG 94

$\Gamma_q$ ;  $\{C_{4z}^+ | 00\frac{1}{2}\}, \{C_{2x} | \frac{1}{2}\frac{1}{2}0\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$\Gamma$ ; (000);  $C_{4z}^+, C_{2x}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $R_5$ ; 2;  $i\sigma_2, \sigma_3, -\sigma_0$ ; C-2 WP; 2  
 $M$ ;  $(\frac{1}{2}\frac{1}{2}0)$ ;  $C_{4z}^+, C_{2z}, C_{2b}, \mathcal{T}$ ;  $\{R_5, R_6\}$ ; 2;  $i\sigma_3, \sigma_0, \sigma_0, \sigma_1$ ; P-NSs;  
 $\{R_7, R_8\}$ ; 2;  $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1$ ; P-NSs;  
 $R_9$ ; 2;  $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0$ ; P-NSs;  
 $Z$ ;  $(00\frac{1}{2})$ ;  $C_{4z}^+, C_{2x}, C_{2z}, \mathcal{T}$ ;  $R_5$ ; 2;  $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ; C-2 WP; 2  
 $R_6$ ; 1; 1, 1, -1, 1;  
 $R_7$ ; 1; 1, -1, -1, 1;  
 $R_8$ ; 1; -1, 1, -1, 1;  
 $R_9$ ; 1; -1, -1, -1, 1;  
 $A$ ;  $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;  $C_{4z}^+, C_{2z}, C_{2a}, \mathcal{T}$ ;  $\{R_5, R_6\}$ ; 2;  $i\sigma_3, \sigma_0, \sigma_0, \sigma_1$ ; P-NSs;  
 $\{R_7, R_8\}$ ; 2;  $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1$ ; P-NSs;  
 $R_9$ ; 2;  $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0$ ; P-NSs;  
 $R$ ;  $(0\frac{1}{2}\frac{1}{2})$ ;  $C_{2y}, C_{2z}, \mathcal{T}$ ;  $R_5$ ; 2;  $i\sigma_2, \sigma_3, -\sigma_0$ ; P-NS<sub>MARX</sub>;  
 $X$ ;  $(0\frac{1}{2}0)$ ;  $C_{2y}, C_{2z}, \mathcal{T}$ ;  $R_5$ ; 2;  $i\sigma_2, \sigma_3, -\sigma_0$ ; P-NS<sub>MARX</sub>;  
 $\Delta$ ;  $\Gamma X$ ;  $C_{2y}, \mathcal{T}C_{2z}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;  
 $U$ ; ZR;  $C_{2y}, \mathcal{T}C_{2z}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{4z}^+, C_{2b}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1;  $i, 1$ ;  
 $R_3$ ; 1; -1, 1;  
 $R_4$ ; 1;  $-i, 1$ ;  
 $V$ ; MA;  $C_{4z}^+, C_{2b}, \mathcal{T}$ ;  $\{R_1, R_3\}$ ; 2;  $\sigma_3, \sigma_1$ ; L-NSs;  
 $\{R_2, R_4\}$ ; 2;  $i\sigma_3, \sigma_1$ ; L-NSs;  
 $\Sigma$ ;  $\Gamma M$ ;  $C_{2a}, C_{2b}, \mathcal{T}$ ;  $R_1$ ; 1; 1, 1;  
 $R_2$ ; 1; -1, 1;  
 $S$ ; ZA;  $C_{2a}, C_{2b}, \mathcal{T}$ ;  $R_2$ ; 1; 1, 1;  
 $R_4$ ; 1; -1, 1;  
 $Y$ ; XM;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $\{R_2, R_4\}$ ; 2;  $\sigma_3, -i\sigma_2$ ; L-NS<sub>MARX</sub>;  
 $T$ ; RA;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $\{R_2, R_4\}$ ; 2;  $\sigma_3, -i\sigma_2$ ; L-NS<sub>MARX</sub>;  
 $W$ ; XR;  $C_{2z}, \mathcal{T}C_{2y}$ ;  $\{R_1, R_2\}$ ; 2;  $\sigma_3, -i\sigma_2$ ; L-NS<sub>MARX</sub>;

SG 95

 $\Gamma_q; \{C_{4z}^+|00\frac{3}{4}\}, \{C_{2x}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$Z; (00\frac{1}{2}); C_{4z}^+, C_{2x}, \mathcal{T}; R_6;$	$R_6;$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
	$R_7;$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2x}, \mathcal{T}; R_6;$	$R_6;$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
	$R_7;$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2x}, \mathcal{T}; R_5;$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T}; R_1;$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$\Delta; \Gamma X; C_{2y}, \mathcal{T} C_{2z}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$U; ZR; C_{2y}, \mathcal{T} C_{2z}; \{R_2, R_4\};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;
$\Lambda; \Gamma Z; C_{4z}^+, C_{2b} \mathcal{T}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $i, 1;$	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; $-i, 1;$	
$V; MA; C_{4z}^+, C_{2b} \mathcal{T}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $i, 1;$	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; $-i, 1;$	
$\Sigma; \Gamma M; C_{2a}, C_{2b} \mathcal{T}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S; ZA; C_{2a}, C_{2b} \mathcal{T}; \{R_4, R_8\};$	$\{R_4, R_8\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ZAR</sub> ;
$Y; XM; C_{2x}, \mathcal{T} C_{2y}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$T; RA; C_{2x}, \mathcal{T} C_{2y}; \{R_1, R_2\};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ZAR</sub> ;
$W; XR; C_{2z}, \mathcal{T} C_{2y}; R_1;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	



SG 96

 $\Gamma_q; \{C_{4z}^+ | 00 \frac{3}{4}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_{4z}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, C_{2z}, C_{2b}, \mathcal{T}; \{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-NSs;
$Z; (00 \frac{1}{2}); C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	2; $\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
	$R_7;$	2; $-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>ZAR</sub> ;
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, C_{2a}, \mathcal{T};$	$\{R_6, R_7\};$	4; $\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, \Gamma_{1,0};$	C-2 DP; 2
$R; (0 \frac{1}{2} \frac{1}{2}); C_{2z}, C_{2x}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NSs;
$X; (0 \frac{1}{2} 0); C_{2y}, C_{2x}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>MARX</sub>
$\Delta; \Gamma X; C_{2y}, \mathcal{T} C_{2z};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$U; ZR; C_{2y}, \mathcal{T} C_{2z};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;
$\Lambda; \Gamma Z; C_{4z}^+, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $i, 1;$	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; $-i, 1;$	
$V; MA; C_{4z}^+, C_{2b}, \mathcal{T};$	$\{R_1, R_3\};$	2; $\sigma_3, \sigma_1;$	L-NSs;
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	L-NSs;
$\Sigma; \Gamma M; C_{2a}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S; ZA; C_{2a}, C_{2b}, \mathcal{T};$	$\{R_4, R_8\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ZAR</sub> ;
$Y; XM; C_{2x}, \mathcal{T} C_{2y};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>MARX</sub> ;
$T; RA; C_{2x}, \mathcal{T} C_{2y};$	$\{R_2, R_2\};$	2; $\sigma_0, -i\sigma_2;$	L-NSs;
	$\{R_4, R_4\};$	2; $-\sigma_0, -i\sigma_2;$	L-NSs;
$W; XR; C_{2z}, \mathcal{T} C_{2y};$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>MARX</sub> ;

SG 97

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$\Gamma$ ; (000);	$C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;
		$R_2$ ;	1; 1, -1, 1;
		$R_3$ ;	1; -1, 1, 1;
		$R_4$ ;	1; -1, -1, 1;
		$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ; C-2 WP; 2
$N$ ; $(0\frac{1}{2}0)$ ;	$C_{2y}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
		$R_2$ ;	1; -1, 1;
$X$ ; $(00\frac{1}{2})$ ;	$C_{2z}, C_{2b}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;
		$R_2$ ;	1; 1, -1, 1;
		$R_3$ ;	1; -1, 1, 1;
		$R_4$ ;	1; -1, -1, 1;
		$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ; C-2 WP; 2
$Z$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;	$C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;
		$R_2$ ;	1; 1, -1, 1;
		$R_3$ ;	1; -1, 1, 1;
		$R_4$ ;	1; -1, -1, 1;
		$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ; C-2 WP; 2
$P$ ; $(\frac{1}{4}\frac{1}{4}\frac{1}{4})$ ;	$C_{2z}, C_{2y}, C_{2b}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;
		$R_2$ ;	1; 1, -1, 1;
		$\{R_3, R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_1$ ; C-2 WP; 2
$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
		$R_2$ ;	1; $i$ , 1;
		$R_3$ ;	1; -1, 1;
		$R_4$ ;	1; $-i$ , 1;
$V$ ; $ZV$ ;	$C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
		$R_2$ ;	1; $i$ , 1;
		$R_3$ ;	1; -1, 1;
		$R_4$ ;	1; $-i$ , 1;
$W$ ; $XP$ ;	$C_{2z}, C_{2b}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
		$R_2$ ;	1; -1, 1;
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$R_1$ ;	1; 1, 1;
		$R_2$ ;	1; -1, 1;
$F$ ; $ZF$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$R_1$ ;	1; 1, 1;
		$R_2$ ;	1; -1, 1;
$Q$ ; $NP$ ;	$C_{2y}$ ;	$R_1$ ;	1; 1;
		$R_2$ ;	1; -1;
$\Delta$ ; $\Gamma X$ ;	$C_{2a}, C_{2b}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
		$R_2$ ;	1; -1, 1;
$U$ ; $ZU$ ;	$C_{2a}, C_{2b}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
		$R_2$ ;	1; -1, 1;
$Y$ ; $XZ/XY$ ;	$C_{2b}, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;
		$R_2$ ;	1; -1, 1;

SG 98

 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{C_{2x} | 0 \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
		$R_2; 1; 1, -1, 1;$	
		$R_3; 1; -1, 1, 1;$	
		$R_4; 1; -1, -1, 1;$	
		$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$N; (0\frac{1}{2}0);$	$C_{2y}, \mathcal{T};$	$R_1; 1; 1, 1;$	
		$R_2; 1; -1, 1;$	
$X; (00\frac{1}{2});$	$C_{2z}, C_{2b}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
		$R_2; 1; 1, -1, 1;$	
		$R_3; 1; -1, 1, 1;$	
		$R_4; 1; -1, -1, 1;$	
$Z; (\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$C_{4z}^+, C_{2x}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
		$R_2; 1; 1, -1, 1;$	
		$R_3; 1; -1, 1, 1;$	
		$R_4; 1; -1, -1, 1;$	
		$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$P; (\frac{1}{4} \frac{1}{4} \frac{1}{4});$	$E, C_{2z}, C_{2y}, C_{2b}, \mathcal{T};$	$R_{10}; 2; -i\sigma_0, \sigma_1, \sigma_3, \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}};$	C-1 WP; 1
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, C_{2b}, \mathcal{T};$	$R_1; 1; 1, 1;$	
		$R_2; 1; i, 1;$	
		$R_3; 1; -1, 1;$	
		$R_4; 1; -i, 1;$	
$V; ZV;$	$C_{4z}^+, E, C_{2b}, \mathcal{T};$	$R_5; 1; 1, 1, 1;$	
		$R_6; 1; i, 1, 1;$	
		$R_7; 1; -1, 1, 1;$	
		$R_8; 1; -i, 1, 1;$	
$W; XP;$	$C_{2z}, C_{2b}, \mathcal{T};$	$R_1; 1; 1, 1;$	
		$R_2; 1; -1, 1;$	
$\Sigma; \Gamma Z/\Gamma \Sigma;$	$C_{2x}, \mathcal{T} C_{2y};$	$R_1; 1; 1, 1;$	
		$R_2; 1; -1, 1;$	
$F; ZF;$	$C_{2x}, \mathcal{T} C_{2y};$	$R_1; 1; 1, 1;$	
		$R_2; 1; -1, 1;$	
$Q; NP;$	$C_{2y};$	$R_2; 1; 1;$	
		$R_4; 1; -1;$	
$\Delta; \Gamma X;$	$C_{2a}, C_{2b}, \mathcal{T};$	$R_1; 1; 1, 1;$	
		$R_2; 1; -1, 1;$	
$U; ZU;$	$C_{2a}, C_{2b}, \mathcal{T};$	$R_2; 1; 1, 1;$	
		$R_4; 1; -1, 1;$	
$Y; XZ/XY;$	$C_{2b}, \mathcal{T} C_{2z};$	$R_1; 1; 1, 1;$	
		$R_2; 1; -1, 1;$	

SG 99

 $\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 1; -1, 1, 1;$		
			$R_4; 1; -1, -1, 1;$		
			$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 1; -1, 1, 1;$		
			$R_4; 1; -1, -1, 1;$		
			$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{MA};$	
$Z;$	$(00\frac{1}{2});$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 1; -1, 1, 1;$		
			$R_4; 1; -1, -1, 1;$		
			$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$A;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 1; -1, 1, 1;$		
			$R_4; 1; -1, -1, 1;$		
			$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{MA};$	
$R;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 1; -1, 1, 1;$		
			$R_4; 1; -1, -1, 1;$		
$X;$	$(0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 1; -1, 1, 1;$		
			$R_4; 1; -1, -1, 1;$		
$\Delta;$	$\Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$		
			$R_2; 1; -1, 1;$		
$U;$	$ZR;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1;$		
			$R_2; 1; -1, 1;$		
$\Lambda;$	$\Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_1; 1; 1, 1;$		
			$R_2; 1; 1, -1;$		
			$R_3; 1; -1, 1;$		
			$R_4; 1; -1, -1;$		
			$R_5; 2; i\sigma_2, \sigma_3;$	QNL;	0
$V;$	$MA;$	$C_{4z}^+, \sigma_y;$	$R_1; 1; 1, 1;$		
			$R_2; 1; 1, -1;$		
			$R_3; 1; -1, 1;$		
			$R_4; 1; -1, -1;$		
			$R_5; 2; i\sigma_2, \sigma_3;$	QNL;	0
$\Sigma;$	$\Gamma M;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1; 1; 1, 1;$		
			$R_2; 1; -1, 1;$		

$$\begin{aligned} S; \text{ ZA}; \sigma_{db}, \mathcal{T}\sigma_{da}; R_1; 1; 1, 1; \\ R_2; 1; -1, 1; \\ Y; \text{ XM}; \sigma_y, \mathcal{T}\sigma_x; R_1; 1; 1, 1; \\ R_2; 1; -1, 1; \\ T; \text{ RA}; \sigma_y, \mathcal{T}\sigma_x; R_1; 1; 1, 1; \\ R_2; 1; -1, 1; \\ W; \text{ XR}; C_{2z}, \sigma_y; R_1; 1; 1, 1; \\ R_2; 1; 1, -1; \\ R_3; 1; -1, 1; \\ R_4; 1; -1, -1; \end{aligned}$$

SG 100

 $\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2z}, \sigma_{db}, \mathcal{T}; \{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$		P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2}); C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2z}, \sigma_{db}, \mathcal{T}; \{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$		P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0); \sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma X; \sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U; ZR; \sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$V; MA; C_{4z}^+, C_{2z}, \sigma_{db};$	$R_5;$	1; $i, -1, -1;$		
	$R_6;$	1; $-i, -1, -1;$		
	$R_7;$	1; $-i, -1, 1;$		
	$R_8;$	1; $i, -1, 1;$		
	$R_9;$	2; $\sigma_1, \sigma_0, -\sigma_3;$	QNL;	0
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; ZA; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$Y; XM; \sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$T; RA; \sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$W; XR; \sigma_y, C_{2z};$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$

## 12. SG 101-110

SG 101

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{MA};$	
$Z; (00\frac{1}{2}); C_{4z}^+, C_{2z}, \sigma_{db}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2z}, \sigma_{db}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$X; (0\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Delta; \Gamma X; \sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U; ZR; \sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$V; MA; C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; ZA; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$Y; XM; \sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		

$$\begin{aligned} T; \text{ RA}; \sigma_y, \mathcal{T}\sigma_x; \{R_1, R_2\}; 2; -i\sigma_3, -i\sigma_2; \text{ WNL}; \pi \\ W; \text{ XR}; C_{2z}, \sigma_y; \begin{array}{ll} R_1; & 1; 1, 1; \\ R_2; & 1; 1, -1; \\ R_3; & 1; -1, 1; \\ R_4; & 1; -1, -1; \end{array} \end{aligned}$$



SG 102

 $\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{\sigma_y | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, C_{2z}, \sigma_{db}, \mathcal{T}; \{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;		
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (00 \frac{1}{2}); C_{4z}^+, C_{2z}, \sigma_{db}, \mathcal{T}; \{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;		
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, \sigma_{db}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{MA};$	
$R; (0 \frac{1}{2} \frac{1}{2}); \sigma_y, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0 \frac{1}{2} 0); \sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma X; \sigma_x, \mathcal{T} C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U; ZR; \sigma_x, \mathcal{T} C_{2z};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$V; MA; C_{4z}^+, C_{2z}, \sigma_{da};$	$R_5;$	1; $i, -1, -1;$		
	$R_6;$	1; $-i, -1, -1;$		
	$R_7;$	1; $-i, -1, 1;$		
	$R_8;$	1; $i, -1, 1;$		
	$R_9;$	2; $\sigma_1, \sigma_0, -\sigma_3;$	QNL;	0
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T} \sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; ZA; \sigma_{db}, \mathcal{T} \sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$Y; XM; \sigma_y, \mathcal{T} \sigma_x;$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$T; RA; \sigma_y, \mathcal{T} \sigma_x;$	$R_2;$	1; $-i, 1;$		
	$R_4;$	1; $i, 1;$		
$W; XR; \sigma_y, C_{2z};$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$

SG 103

 $\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$ (000); $C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M;$ ( $\frac{1}{2}\frac{1}{2}0$ ); $C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{MA};$	
$Z;$ ( $00\frac{1}{2}$ ); $C_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_5, R_6\};$	2; $-\sigma_0, i\sigma_3, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $\sigma_0, -i\sigma_3, \sigma_1;$	P-WNLs;	
	$\{R_{10}, R_{10}\};$	4; $i\Gamma_{0,3}, i\Gamma_{0,2}, -\Gamma_{2,2};$	DP;	0
$A;$ ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $C_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_5, R_6\};$	2; $-\sigma_0, i\sigma_3, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $\sigma_0, -i\sigma_3, \sigma_1;$	P-WNLs;	
	$\{R_{10}, R_{10}\};$	4; $i\Gamma_{0,3}, i\Gamma_{0,2}, -\Gamma_{2,2};$	DP;	0
$R;$ ( $0\frac{1}{2}\frac{1}{2}$ ); $\sigma_x, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$X;$ ( $0\frac{1}{2}0$ ); $C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Delta;$ $\Gamma X;$ $\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U;$ $ZR;$ $\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Lambda;$ $\Gamma Z;$ $C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$V;$ $MA;$ $C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$\Sigma;$ $\Gamma M;$ $\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S;$ $ZA;$ $\sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y;$ $XM;$ $\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$T;$ $RA;$ $\sigma_y, \mathcal{T}\sigma_x;$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$W;$ $XR;$ $C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		

SG 104

 $\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$ (000); $C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M;$ ( $\frac{1}{2}\frac{1}{2}0$ ); $C_{4z}^+, C_{2z}, \sigma_{db}, \mathcal{T};$ $\{R_5, R_6\};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z;$ ( $00\frac{1}{2}$ ); $C_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_5, R_6\};$	2; $-\sigma_0, i\sigma_3, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $\sigma_0, -i\sigma_3, \sigma_1;$	P-WNLs;	
	$\{R_{10}, R_{10}\};$	4; $i\Gamma_{0,3}, i\Gamma_{0,2}, -\Gamma_{2,2};$	DP;	0
$A;$ ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $C_{4z}^+, C_{2z}, \sigma_x, \mathcal{T};$ $\{R_5, R_6\};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$R;$ ( $0\frac{1}{2}\frac{1}{2}$ ); $\sigma_y, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X;$ ( $0\frac{1}{2}0$ ); $\sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Delta;$ $\Gamma X;$ $\sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U;$ ZR; $\sigma_x, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Lambda;$ $\Gamma Z;$ $C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$V;$ MA; $C_{4z}^+, C_{2z}, \sigma_{da};$	$R_5;$	1; $i, -1, -1;$		
	$R_6;$	1; $-i, -1, -1;$		
	$R_7;$	1; $-i, -1, 1;$		
	$R_8;$	1; $i, -1, 1;$		
	$R_9;$	2; $\sigma_1, \sigma_0, -\sigma_3;$	QNL;	0
$\Sigma;$ $\Gamma M;$ $\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S;$ ZA; $\sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y;$ XM; $\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$T;$ RA; $\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	1; $-i, 1;$		
	$R_4;$	1; $i, 1;$		
$W;$ XR; $\sigma_y, C_{2z};$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$

SG 105

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{MA};$	
$Z; (00\frac{1}{2}); C_{4z}^+, C_{2z}, \sigma_x, \mathcal{T}; \{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;		
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2z}, \sigma_x, \mathcal{T}; \{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;		
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$X; (0\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Delta; \Gamma X; \sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U; ZR; \sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$V; MA; C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; ZA; \sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XM; \sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		

$$\begin{array}{l} T; \text{ RA}; \sigma_y, \mathcal{T}\sigma_x; R_1; 1; 1, 1; \\ \qquad R_2; 1; -1, 1; \\ W; \text{ XR}; C_{2z}, \sigma_y; R_1; 1; 1, 1; \\ \qquad R_2; 1; 1, -1; \\ \qquad R_3; 1; -1, 1; \\ \qquad R_4; 1; -1, -1; \end{array}$$

SG 106

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2z}, \sigma_{db}, \mathcal{T}; \{R_5, R_6\};$		2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2}); C_{4z}^+, C_{2z}, \sigma_y, \mathcal{T}; \{R_5, R_6\};$		2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_5, R_6\};$	2; $-\sigma_0, i\sigma_3, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $\sigma_0, -i\sigma_3, \sigma_1;$	P-WNLs;	
	$\{R_{10}, R_{10}\};$	4; $i\Gamma_{0,3}, i\Gamma_{0,2}, -\Gamma_{2,2};$	DP;	0
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0); \sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma X; \sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U; ZR; \sigma_x, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$V; MA; C_{4z}^+, C_{2z}, \sigma_{da};$	$R_5;$	1; $i, -1, -1;$		
	$R_6;$	1; $-i, -1, -1;$		
	$R_7;$	1; $-i, -1, 1;$		
	$R_8;$	1; $i, -1, 1;$		
	$R_9;$	2; $\sigma_1, \sigma_0, -\sigma_3;$	QNL;	0
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; ZA; \sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XM; \sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$T; RA; \sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$W; XR; \sigma_y, C_{2z};$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$

SG 107

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$X; (00\frac{1}{2});$	$C_{2z}, \sigma_{db}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, \sigma_{db}, C_{4z}^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$\{R_3, R_4\}; 2; -\sigma_0, \sigma_3, -i\sigma_2;$			P-WNLs;
		$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
		$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
		$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
$V; ZV;$	$C_{4z}^+, \sigma_y;$	$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
		$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
		$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
$W; XP;$	$C_{2z}, \sigma_{db};$	$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
		$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$F; ZF;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$Q; NP;$	$E, \mathcal{T}\sigma_y;$	$R_1;$	1; 1, 1;		
$\Delta; \Gamma X;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$U; ZU;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$Y; XZ/XY;$	$\sigma_{da}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		

SG 108

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	P-WNLs;	
$X; (00\frac{1}{2});$	$C_{2z}, \sigma_{db}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$\sigma_{db}, C_{2z}, C_{4z}^+, \mathcal{T};$	$\{R_1, R_3\};$	2; $\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_2, R_2\};$	2; $\sigma_0, -\sigma_0, -i\sigma_2;$	P-WNLs;	
		$\{R_4, R_4\};$	2; $-\sigma_0, -\sigma_0, -i\sigma_2;$	P-WNLs;	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
		$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$V; ZV;$	$C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
		$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$W; XP;$	$C_{2z}, \sigma_{db};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
		$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$F; ZF;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; -1, 1;		
		$R_2;$	1; 1, 1;		
$Q; NP;$	$E, \mathcal{T}\sigma_y;$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$\Delta; \Gamma X;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$U; ZU;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; -1, 1;		
		$R_2;$	1; 1, 1;		
$Y; XZ/XY;$	$\sigma_{da}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		



SG 109

 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{\sigma_y | 000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$X; (00\frac{1}{2});$	$\sigma_{db}, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, C_{2z}, \sigma_x, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
		$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$\sigma_{da}, C_{2z}, C_{4z}^+, \mathcal{T};$	$R_{10};$	2; $(-1)^{-1/4} \sigma_3, \sigma_2, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	P-WNL $_{XP};$	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
		$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$V; ZV;$	$C_{4z}^+, C_{2z}, \sigma_y;$	$R_5;$	1; $i, 1, 1;$		
		$R_6;$	1; $-i, 1, 1;$		
		$R_7;$	1; $-i, 1, -1;$		
		$R_8;$	1; $i, 1, -1;$		
		$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3;$	QNL;	0
$W; XP;$	$\sigma_{da}, C_{2z};$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$F; ZF;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$Q; NP;$	$E, \mathcal{T}\sigma_y;$	$R_1;$	1; 1, 1;		
$\Delta; \Gamma X;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$U; ZU;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XZ/XY;$	$\sigma_{da}, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$

SG 110

 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{\sigma_y | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	P-WNLs;	
$X; (00\frac{1}{2});$	$\sigma_{db}, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, C_{2z}, \sigma_x, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
		$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$\sigma_{da}, C_{2z}, C_{4z}^+, \mathcal{T};$	$\{R_{10}, R_{10}\};$	4; $e^{-i\pi/4}\Gamma_{0,3}, \Gamma_{0,2}, \frac{i(\Gamma_{2,0}+i\Gamma_{2,2})}{\sqrt{2}};$	DP;	0
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	1; -1, 1;		
		$R_4;$	1; -1, -1;		
		$R_5;$	2; $i\sigma_2, \sigma_3;$	QNL;	0
$V; ZV;$	$C_{4z}^+, C_{2z}, \sigma_y;$	$R_5;$	1; $i, 1, 1;$		
		$R_6;$	1; $-i, 1, 1;$		
		$R_7;$	1; $-i, 1, -1;$		
		$R_8;$	1; $i, 1, -1;$		
		$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3;$	QNL;	0
$W; XP;$	$\sigma_{da}, C_{2z};$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$F; ZF;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_1;$	1; -1, 1;		
		$R_2;$	1; 1, 1;		
$Q; NP;$	$E, \mathcal{T}\sigma_y;$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$\Delta; \Gamma X;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$U; ZU;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XZ/XY;$	$\sigma_{da}, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$

SG 111

 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$\Gamma$ ; $(000)$ ; $S_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{\Gamma Z}$ ;
$M$ ; $(\frac{1}{2}\frac{1}{2}0)$ ; $S_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{MA}$ ;
$Z$ ; $(00\frac{1}{2})$ ; $S_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{\Gamma Z}$ ;
$A$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $S_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{MA}$ ;
$R$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{MA}$ ;
$X$ ; $(0\frac{1}{2}0)$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$R_3$ ;	1; -1, 1, 1;	
	$R_4$ ;	1; -1, -1, 1;	
	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{MA}$ ;
$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;	
	$R_2$ ;	1; -1, 1;	
$U$ ; $ZR$ ; $C_{2y}, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;	
	$R_2$ ;	1; -1, 1;	
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$\{R_3, R_4\}$ ;	2; $-\sigma_0, \sigma_3, -i\sigma_2$ ;	QNL; 0
$V$ ; $MA$ ; $C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
	$R_2$ ;	1; 1, -1, 1;	
	$\{R_3, R_4\}$ ;	2; $-\sigma_0, \sigma_3, -i\sigma_2$ ;	QNL; 0
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$R_1$ ;	1; 1, 1;	
	$R_2$ ;	1; -1, 1;	
$S$ ; $ZA$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$R_1$ ;	1; 1, 1;	
	$R_2$ ;	1; -1, 1;	

$$\begin{aligned} Y; \text{ XM}; C_{2x}, \mathcal{T}C_{2y}; R_1; 1; 1, 1; \\ R_2; 1; -1, 1; \\ T; \text{ RA}; C_{2x}, \mathcal{T}C_{2y}; R_1; 1; 1, 1; \\ R_2; 1; -1, 1; \\ W; \text{ XR}; C_{2z}, \mathcal{T}C_{2y}; R_1; 1; 1, 1; \\ R_2; 1; -1, 1; \end{aligned}$$

SG 112

 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{MA};$	
$Z; (00\frac{1}{2}); S_{4z}^+, C_{2z}, C_{2x}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, C_{2z}, C_{2x}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U; ZR; C_{2y}, \mathcal{T}C_{2z};$	$R_2;$	1; 1, 1;		
	$R_4;$	1; -1, 1;		
$\Lambda; \Gamma Z; C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$V; MA; C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; ZA; \sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XM; C_{2x}, \mathcal{T}C_{2y};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$T; RA; C_{2x}, \mathcal{T}C_{2y};$	$R_2;$	1; 1, 1;		
	$R_4;$	1; -1, 1;		
$W; XR; C_{2z}, \mathcal{T}C_{2y};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2z}, \sigma_{db}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-NSs;
$Z; (00\frac{1}{2}); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, C_{2z}, \sigma_{db}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-NSs;
$R; (0\frac{1}{2}\frac{1}{2}); C_{2y}, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS $_{MARX};$
$X; (0\frac{1}{2}0); C_{2y}, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS $_{MARX};$
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$U; ZR; C_{2y}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$\Lambda; \Gamma Z; C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL; 0
$V; MA; C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_0, -\sigma_3, \sigma_1;$	L-NS $_{MARX}$
	$\{R_3, R_3\};$	2; $-\sigma_0, -\sigma_0, -i\sigma_2;$	L-NS $_{MARX}$
	$\{R_4, R_4\};$	2; $-\sigma_0, \sigma_0, -i\sigma_2;$	L-NS $_{MARX}$
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S; ZA; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$Y; XM; C_{2x}, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS $_{MARX}$
$T; RA; C_{2x}, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS $_{MARX}$
$W; XR; C_{2z}, \mathcal{T}C_{2y};$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	L-NS $_{MARX}$

SG 114

 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2z}, \sigma_{db}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-NSs;	
$Z; (00\frac{1}{2}); S_{4z}^+, C_{2z}, C_{2x}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_5, R_6\};$	2; $-\sigma_0, i\sigma_3, \sigma_1;$	P-NSs;	
	$\{R_7, R_8\};$	2; $\sigma_0, -i\sigma_3, \sigma_1;$	P-NSs;	
	$\{R_{10}, R_{10}\};$	4; $i\Gamma_{0,3}, i\Gamma_{0,2}, -\Gamma_{2,2};$	QDP;	0
$R; (0\frac{1}{2}\frac{1}{2}); C_{2y}, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS $_{MARX}$ ;	
$X; (0\frac{1}{2}0); C_{2y}, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS $_{MARX}$ ;	
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
	$R_4;$	1; -1, 1;		
$U; ZR; C_{2y}, \mathcal{T}C_{2z};$	$R_2;$	1; 1, 1;		
	$R_4;$	1; -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS $_{MARX}$ ;	
$\Lambda; \Gamma Z; C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$V; MA; C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_0, -\sigma_3, \sigma_1;$	L-NS $_{MARX}$	
	$\{R_3, R_3\};$	2; $-\sigma_0, -\sigma_0, -i\sigma_2;$	L-NS $_{MARX}$	
	$\{R_4, R_4\};$	2; $-\sigma_0, \sigma_0, -i\sigma_2;$	L-NS $_{MARX}$	
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; ZA; \sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XM; C_{2x}, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS $_{MARX}$	
$T; RA; C_{2x}, \mathcal{T}C_{2y};$	$\{R_1, R_2\};$	2; $-\sigma_3, -i\sigma_2;$	L-NS $_{MARX}$	
$W; XR; C_{2z}, \mathcal{T}C_{2y};$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	L-NS $_{MARX}$	

SG 115

 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{\Gamma Z}$ ;
$M; (\frac{1}{2} \frac{1}{2} 0); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{MA}$ ;
$Z; (00 \frac{1}{2}); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{\Gamma Z}$ ;
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{MA}$ ;
$R; (0 \frac{1}{2} \frac{1}{2}); C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{MA}$ ;
$X; (0 \frac{1}{2} 0); C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{MA}$ ;
$\Delta; \Gamma X; \sigma_x, \mathcal{T}\sigma_y;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$U; ZR; \sigma_x, \mathcal{T}\sigma_y;$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, S_{4z}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
$V; MA; C_{2z}, \sigma_y, S_{4z}^+, \mathcal{T};$	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2$ ;	QNL; 0
	$R_1;$	1; 1, 1, 1;	
$\Sigma; \Gamma M; C_{2a}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S; ZA; C_{2a}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$Y; XM; \sigma_y, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	



$$\begin{array}{l} T; \text{ RA}; \sigma_y, \mathcal{T}C_{2z}; R_1; 1; 1, 1; \\ \qquad \qquad \qquad R_2; 1; -1, 1; \\ W; \text{ XR}; C_{2z}, \sigma_y; R_1; 1; 1, 1; \\ \qquad \qquad \qquad R_2; 1; 1, -1; \\ \qquad \qquad \qquad R_3; 1; -1, 1; \\ \qquad \qquad \qquad R_4; 1; -1, -1; \end{array}$$

SG 116

 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{MA};$	
$Z; (00\frac{1}{2}); S_{4z}^+, C_{2z}, C_{2a}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, C_{2z}, C_{2a}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$X; (0\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Delta; \Gamma X; \sigma_x, \mathcal{T}\sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U; ZR; \sigma_x, \mathcal{T}\sigma_y;$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$V; MA; C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$\Sigma; \Gamma M; C_{2a}, C_{2b} \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; ZA; C_{2a}, C_{2b} \mathcal{T};$	$R_2;$	1; 1, 1;		
	$R_4;$	1; -1, 1;		
$Y; XM; \sigma_y, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$T; RA; \sigma_y, \mathcal{T}C_{2z};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	WNL;	$\pi$
$W; XR; C_{2z}, \sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		

SG 117

 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2z}, C_{2a}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2}); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, C_{2z}, C_{2a}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0); \sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma X; \sigma_x, \mathcal{T}\sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U; ZR; \sigma_x, \mathcal{T}\sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$V; MA; \sigma_x, C_{2z}, S_{4z}^+ \mathcal{T};$	$R_2;$	1; $-i, 1, 1;$		
	$R_4;$	1; $i, 1, 1;$		
	$\{R_6, R_8\};$	2; $-i\sigma_3, -\sigma_0, -i\sigma_2;$	QNL;	0
$\Sigma; \Gamma M; C_{2a}, C_{2b} \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; ZA; C_{2a}, C_{2b} \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$Y; XM; \sigma_y, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$T; RA; \sigma_y, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$W; XR; \sigma_y, C_{2z};$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$

SG 118

 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2z}, C_{2a}, \mathcal{T}; \{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;		
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2}); S_{4z}^+, C_{2z}, C_{2a}, \mathcal{T}; \{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;		
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{MA};$	
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_y, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0); \sigma_x, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma X; \sigma_x, \mathcal{T}\sigma_y;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$U; ZR; \sigma_x, \mathcal{T}\sigma_y;$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$V; MA; \sigma_x, C_{2z}, S_{4z}^+ \mathcal{T};$	$R_2;$	1; $-i, 1, 1;$		
	$R_4;$	1; $i, 1, 1;$		
	$\{R_6, R_8\};$	2; $-i\sigma_3, -\sigma_0, -i\sigma_2;$	QNL;	0
$\Sigma; \Gamma M; C_{2a}, C_{2b} \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; ZA; C_{2a}, C_{2b} \mathcal{T};$	$R_2;$	1; 1, 1;		
	$R_4;$	1; -1, 1;		
$Y; XM; \sigma_y, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$T; RA; \sigma_y, \mathcal{T}C_{2z};$	$R_2;$	1; $-i, 1;$		
	$R_4;$	1; $i, 1;$		
$W; XR; \sigma_y, C_{2z};$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$

SG 119

 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2a}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$N; (0\frac{1}{2}0);$	$\sigma_y, \mathcal{T};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
$X; (00\frac{1}{2});$	$C_{2z}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, \mathcal{T}\sigma_y;$	$R_1;$	1; 1, 1;	
		$R_2;$	1; $i, 1;$	
		$R_3;$	1; -1, 1;	
		$R_4;$	1; $-i, 1;$	
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{2z}, \sigma_y, S_{4z}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL; 0
		$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
$V; ZV;$	$C_{2z}, \sigma_y, S_{4z}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL; 0
		$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
$W; XP;$	$C_{2z}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_3;$	1; 1, 1;	
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\sigma_y, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_3;$	1; 1, 1;	
$F; ZF;$	$\sigma_y, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_3;$	1; 1, 1;	
$Q; NP;$	$E, \mathcal{T}\sigma_y;$	$R_1;$	1; 1, 1;	
		$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
$\Delta; \Gamma X;$	$C_{2a}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_3;$	1; 1, 1;	
$U; ZU;$	$C_{2a}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_3;$	1; 1, 1;	
$Y; XZ/XY;$	$C_{2b}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
		$R_3;$	1; 1, 1;	

SG 120

 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	P-WNLs;	
$X; (00\frac{1}{2});$	$C_{2z}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_{4z}^+, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, \mathcal{T}\sigma_y;$	$\{R_1, R_3\};$	2; $\sigma_3, -i\sigma_2;$	P-WNLs;	
		$\{R_2, R_4\};$	2; $i\sigma_3, -i\sigma_2;$	P-WNLs;	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$V; ZV;$	$C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$W; XP;$	$C_{2z}, C_{2b} \mathcal{T};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$\Sigma; \Gamma Z/\Gamma \Sigma;$	$\sigma_y, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$F; ZF;$	$\sigma_y, \mathcal{T}C_{2z};$	$R_1;$	1; -1, 1;		
		$R_2;$	1; 1, 1;		
$Q; NP;$	$E, \mathcal{T}\sigma_y;$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$\Delta; \Gamma X;$	$C_{2a}, C_{2b} \mathcal{T};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$U; ZU;$	$C_{2a}, C_{2b} \mathcal{T};$	$R_1;$	1; -1, 1;		
		$R_2;$	1; 1, 1;		
$Y; XZ/XY;$	$C_{2b}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		

SG 121

 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$\Gamma$ ; (000);	$S_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
		$R_2$ ;	1; 1, -1, 1;	
		$R_3$ ;	1; -1, 1, 1;	
		$R_4$ ;	1; -1, -1, 1;	
		$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{\Gamma Z}$ ;
$N$ ; (0 $\frac{1}{2}$ 0);	$C_{2y}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$X$ ; (00 $\frac{1}{2}$ );	$C_{2z}, \sigma_{db}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
		$R_2$ ;	1; 1, -1, 1;	
		$R_3$ ;	1; -1, 1, 1;	
		$R_4$ ;	1; -1, -1, 1;	
$Z$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$S_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
		$R_2$ ;	1; 1, -1, 1;	
		$R_3$ ;	1; -1, 1, 1;	
		$R_4$ ;	1; -1, -1, 1;	
		$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-QNL $_{\Gamma Z}$ ;
$P$ ; ( $\frac{1}{4}\frac{1}{4}\frac{1}{4}$ );	$S_{4z}^+, C_{2x}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; 1, -1;	
		$R_3$ ;	1; -1, 1;	
		$R_4$ ;	1; -1, -1;	
		$R_5$ ;	2; $i\sigma_2, \sigma_3$ ;	P-WNLs;
$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
		$R_2$ ;	1; 1, -1, 1;	
		$\{R_3, R_4\}$ ;	2; $-\sigma_0, \sigma_3, -i\sigma_2$ ;	QNL; 0
$V$ ; ZV;	$C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;	
		$R_2$ ;	1; 1, -1, 1;	
		$\{R_3, R_4\}$ ;	2; $-\sigma_0, \sigma_3, -i\sigma_2$ ;	QNL; 0
$W$ ; XP;	$C_{2z}, \sigma_{db}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; 1, -1;	
		$R_3$ ;	1; -1, 1;	
		$R_4$ ;	1; -1, -1;	
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$F$ ; ZF;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$Q$ ; NP;	$C_{2y}$ ;	$R_1$ ;	1; 1;	
		$R_2$ ;	1; -1;	
$\Delta$ ; $\Gamma X$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$U$ ; ZU;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	
$Y$ ; XZ/XY;	$\sigma_{da}, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;	
		$R_2$ ;	1; -1, 1;	

SG 122

 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2x}|\frac{1}{4}\frac{3}{4}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$S_{4z}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$X; (00\frac{1}{2});$	$\sigma_{db}, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_{4z}^+, C_{2z}, C_{2x}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
		$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
		$R_{13};$	2; $e^{i\pi/4} \frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -i\sigma_0, \sigma_1;$	P-WNL $_{XP};$	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, E, C_{2y};$	$R_{14};$	2; $-e^{i\pi/4} \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_0, \sigma_1;$	P-WNL $_{XP};$	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$V; ZV;$	$\sigma_{da}, C_{2z}, S_{4z}^+ \mathcal{T};$	$R_2;$	1; $-i, 1, 1;$		
		$R_4;$	1; $i, 1, 1;$		
		$\{R_6, R_8\};$	2; $-i\sigma_3, -\sigma_0, -i\sigma_2;$	QNL;	0
$W; XP;$	$\sigma_{da}, C_{2z};$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$C_{2x}, \mathcal{T}C_{2y};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$F; ZF;$	$C_{2x}, \mathcal{T}C_{2y};$	$R_2;$	1; 1, 1;		
		$R_4;$	1; -1, 1;		
$Q; NP;$	$C_{2y};$	$R_4;$	1; 1;		
		$R_8;$	1; -1;		
$\Delta; \Gamma X;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$U; ZU;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XZ/XY;$	$\sigma_{da}, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$



SG 123

 $\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

- $\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$   $R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; 1, -1, 1, 1;$   
 $R_3; 1; -1, 1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-QNL}_{\Gamma Z};$   
 $R_6; 1; 1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, 1, -1, 1;$   
 $R_9; 1; -1, -1, -1, 1;$   
 $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-QNL}_{\Gamma Z};$
- $M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, C_{2x}, I, \mathcal{T};$   $R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; 1, -1, 1, 1;$   
 $R_3; 1; -1, 1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-QNL}_{MA};$   
 $R_6; 1; 1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, 1, -1, 1;$   
 $R_9; 1; -1, -1, -1, 1;$   
 $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-QNL}_{MA};$
- $Z; (00 \frac{1}{2}); C_{4z}^+, C_{2x}, I, \mathcal{T};$   $R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; 1, -1, 1, 1;$   
 $R_3; 1; -1, 1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-QNL}_{\Gamma Z};$   
 $R_6; 1; 1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, 1, -1, 1;$   
 $R_9; 1; -1, -1, -1, 1;$   
 $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-QNL}_{\Gamma Z};$
- $A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, C_{2x}, I, \mathcal{T};$   $R_1; 1; 1, 1, 1, 1;$   
 $R_2; 1; 1, -1, 1, 1;$   
 $R_3; 1; -1, 1, 1, 1;$   
 $R_4; 1; -1, -1, 1, 1;$   
 $R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{P-QNL}_{MA};$   
 $R_6; 1; 1, 1, -1, 1;$   
 $R_7; 1; 1, -1, -1, 1;$   
 $R_8; 1; -1, 1, -1, 1;$   
 $R_9; 1; -1, -1, -1, 1;$   
 $R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0; \text{P-QNL}_{MA};$

$R$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_{2z}, C_{2y}, I, \mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1, 1;
	$R_2$ ; 1; -1, 1, 1, 1;
	$R_3$ ; 1; 1, -1, 1, 1;
	$R_4$ ; 1; -1, -1, 1, 1;
	$R_5$ ; 1; 1, 1, -1, 1;
	$R_6$ ; 1; -1, 1, -1, 1;
	$R_7$ ; 1; 1, -1, -1, 1;
	$R_8$ ; 1; -1, -1, -1, 1;
$X$ ; $(0\frac{1}{2}0)$ ; $C_{2z}, C_{2y}, I, \mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1, 1;
	$R_2$ ; 1; -1, 1, 1, 1;
	$R_3$ ; 1; 1, -1, 1, 1;
	$R_4$ ; 1; -1, -1, 1, 1;
	$R_5$ ; 1; 1, 1, -1, 1;
	$R_6$ ; 1; -1, 1, -1, 1;
	$R_7$ ; 1; 1, -1, -1, 1;
	$R_8$ ; 1; -1, -1, -1, 1;
$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;
	$R_2$ ; 1; 1, -1, 1;
	$R_3$ ; 1; -1, 1, 1;
	$R_4$ ; 1; -1, -1, 1;
$U$ ; $ZR$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;
	$R_2$ ; 1; 1, -1, 1;
	$R_3$ ; 1; -1, 1, 1;
	$R_4$ ; 1; -1, -1, 1;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;
	$R_2$ ; 1; 1, -1, 1;
	$R_3$ ; 1; -1, 1, 1;
	$R_4$ ; 1; -1, -1, 1;
	$R_5$ ; 2; $i\sigma_2, \sigma_3, -\sigma_0$ ; QNL; 0
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;
	$R_2$ ; 1; 1, -1, 1;
	$R_3$ ; 1; -1, 1, 1;
	$R_4$ ; 1; -1, -1, 1;
	$R_5$ ; 2; $i\sigma_2, \sigma_3, -\sigma_0$ ; QNL; 0
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;
	$R_2$ ; 1; 1, -1, 1;
	$R_3$ ; 1; -1, 1, 1;
	$R_4$ ; 1; -1, -1, 1;
$S$ ; $ZA$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;
	$R_2$ ; 1; 1, -1, 1;
	$R_3$ ; 1; -1, 1, 1;
	$R_4$ ; 1; -1, -1, 1;
$Y$ ; $XM$ ; $C_{2x}, \sigma_z, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;
	$R_2$ ; 1; 1, -1, 1;
	$R_3$ ; 1; -1, 1, 1;
	$R_4$ ; 1; -1, -1, 1;

$T; \text{ RA}; C_{2x,\sigma_z}, I\mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$   
 $W; \text{ XR}; C_{2z,\sigma_y}, I\mathcal{T}; R_1; 1; 1, 1, 1;$   
 $R_2; 1; 1, -1, 1;$   
 $R_3; 1; -1, 1, 1;$   
 $R_4; 1; -1, -1, 1;$

SG 124

 $\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; (000); $C_{4z}^+, C_{2x}, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1, 1;		
	$R_2$ ;	1; 1, -1, 1, 1;		
	$R_3$ ;	1; -1, 1, 1, 1;		
	$R_4$ ;	1; -1, -1, 1, 1;		
	$R_5$ ;	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-QNL $_{\Gamma Z}$ ;	
	$R_6$ ;	1; 1, 1, -1, 1;		
	$R_7$ ;	1; 1, -1, -1, 1;		
	$R_8$ ;	1; -1, 1, -1, 1;		
	$R_9$ ;	1; -1, -1, -1, 1;		
	$R_{10}$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-QNL $_{\Gamma Z}$ ;	
$M$ ; ( $\frac{1}{2}\frac{1}{2}0$ ); $C_{4z}^+, C_{2x}, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1, 1;		
	$R_2$ ;	1; 1, -1, 1, 1;		
	$R_3$ ;	1; -1, 1, 1, 1;		
	$R_4$ ;	1; -1, -1, 1, 1;		
	$R_5$ ;	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-QNL $_{MA}$ ;	
	$R_6$ ;	1; 1, 1, -1, 1;		
	$R_7$ ;	1; 1, -1, -1, 1;		
	$R_8$ ;	1; -1, 1, -1, 1;		
	$R_9$ ;	1; -1, -1, -1, 1;		
	$R_{10}$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-QNL $_{MA}$ ;	
$Z$ ; ( $00\frac{1}{2}$ ); $I, \sigma_{db}, C_{4z}^+, \mathcal{T}$ ;	$R_{10}$ ;	2; $-\sigma_3, i\sigma_2, \sigma_0, -\sigma_0$ ;	P-WNLs;	
	$R_{11}$ ;	2; $-\sigma_3, i\sigma_2, -\sigma_0, -\sigma_0$ ;	P-WNLs;	
	$\{R_{12}, R_{13}\}$ ;	4; $-\Gamma_{0,3}, i\Gamma_{0,2}, -i\Gamma_{3,3}, \Gamma_{1,0}$ ;	QDP;	0
$A$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $I, \sigma_{db}, C_{4z}^+, \mathcal{T}$ ;	$R_{10}$ ;	2; $-\sigma_3, i\sigma_2, \sigma_0, -\sigma_0$ ;	P-WNLs;	
	$R_{11}$ ;	2; $-\sigma_3, i\sigma_2, -\sigma_0, -\sigma_0$ ;	P-WNLs;	
	$\{R_{12}, R_{13}\}$ ;	4; $-\Gamma_{0,3}, i\Gamma_{0,2}, -i\Gamma_{3,3}, \Gamma_{1,0}$ ;	QDP;	0
$R$ ; ( $0\frac{1}{2}\frac{1}{2}$ ); $\sigma_x, C_{2y}, C_{2z}, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-WNLs;	
	$R_{10}$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-WNLs;	
$X$ ; ( $0\frac{1}{2}0$ ); $C_{2z}, C_{2y}, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1, 1;		
	$R_2$ ;	1; -1, 1, 1, 1;		
	$R_3$ ;	1; 1, -1, 1, 1;		
	$R_4$ ;	1; -1, -1, 1, 1;		
	$R_5$ ;	1; 1, 1, -1, 1;		
	$R_6$ ;	1; -1, 1, -1, 1;		
	$R_7$ ;	1; 1, -1, -1, 1;		
	$R_8$ ;	1; -1, -1, -1, 1;		
$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, I, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;		
	$R_2$ ;	1; 1, -1, 1;		
	$R_3$ ;	1; -1, 1, 1;		
	$R_4$ ;	1; -1, -1, 1;		
$U$ ; ZR; $\sigma_z, C_{2y}, I, \mathcal{T}$ ;	$R_5$ ;	2; $\sigma_2, \sigma_3, -i\sigma_1$ ;	WNL;	$\pi$

$$\begin{aligned}
&\Lambda; \quad \Gamma Z; \quad C_{4z, \sigma_y, IT}^+; \quad R_1; \quad 1; \quad 1, 1, 1; \\
&\quad \quad \quad R_2; \quad 1; \quad 1, -1, 1; \\
&\quad \quad \quad R_3; \quad 1; \quad -1, 1, 1; \\
&\quad \quad \quad R_4; \quad 1; \quad -1, -1, 1; \\
&\quad \quad \quad R_5; \quad 2; \quad i\sigma_2, \sigma_3, -\sigma_0; \quad \text{QNL}; \quad 0 \\
&V; \quad \text{MA}; \quad C_{4z, \sigma_y, IT}^+; \quad R_1; \quad 1; \quad 1, 1, 1; \\
&\quad \quad \quad R_2; \quad 1; \quad 1, -1, 1; \\
&\quad \quad \quad R_3; \quad 1; \quad -1, 1, 1; \\
&\quad \quad \quad R_4; \quad 1; \quad -1, -1, 1; \\
&\quad \quad \quad R_5; \quad 2; \quad i\sigma_2, \sigma_3, -\sigma_0; \quad \text{QNL}; \quad 0 \\
&\Sigma; \quad \Gamma M; \quad C_{2a, \sigma_z, IT}; \quad R_1; \quad 1; \quad 1, 1, 1; \\
&\quad \quad \quad R_2; \quad 1; \quad 1, -1, 1; \\
&\quad \quad \quad R_3; \quad 1; \quad -1, 1, 1; \\
&\quad \quad \quad R_4; \quad 1; \quad -1, -1, 1; \\
&S; \quad \text{ZA}; \quad \sigma_z, C_{2a, IT}; \quad R_5; \quad 2; \quad \sigma_2, \sigma_3, -i\sigma_1; \quad \text{WNL}; \quad \pi \\
&Y; \quad \text{XM}; \quad C_{2x, \sigma_z, IT}; \quad R_1; \quad 1; \quad 1, 1, 1; \\
&\quad \quad \quad R_2; \quad 1; \quad 1, -1, 1; \\
&\quad \quad \quad R_3; \quad 1; \quad -1, 1, 1; \\
&\quad \quad \quad R_4; \quad 1; \quad -1, -1, 1; \\
&T; \quad \text{RA}; \quad \sigma_z, C_{2x, IT}; \quad R_5; \quad 2; \quad \sigma_2, \sigma_3, -i\sigma_1; \quad \text{WNL}; \quad \pi \\
&W; \quad \text{XR}; \quad C_{2z, \sigma_y, IT}; \quad R_1; \quad 1; \quad 1, 1, 1; \\
&\quad \quad \quad R_2; \quad 1; \quad 1, -1, 1; \\
&\quad \quad \quad R_3; \quad 1; \quad -1, 1, 1; \\
&\quad \quad \quad R_4; \quad 1; \quad -1, -1, 1;
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; 1, -1, 1, 1;$	
	$R_3; 1; -1, 1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
	$R_6; 1; 1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, 1, -1, 1;$	
	$R_9; 1; -1, -1, -1, 1;$	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_9; 2; \sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{11}; 2; -i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{12}; 2; -\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{14}; 2; -i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
$Z; (00\frac{1}{2}); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; 1, -1, 1, 1;$	
	$R_3; 1; -1, 1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
	$R_6; 1; 1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, 1, -1, 1;$	
	$R_9; 1; -1, -1, -1, 1;$	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_9; 2; \sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{11}; 2; -i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{12}; 2; -\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{14}; 2; -i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
$R; (0\frac{1}{2} \frac{1}{2}); \sigma_x, \sigma_y, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;
$X; (0\frac{1}{2} 0); \sigma_x, \sigma_y, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;
$\Delta; \Gamma X; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$U; ZR; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	QNL; 0

$V$ ; MA; $C_{4z}^+, C_{2z}, \sigma_{da}, IT$ ;	$R_5$ ; 1; $-i, 1, 1, 1$ ;	
	$R_6$ ; 1; $i, 1, 1, 1$ ;	
	$R_7$ ; 1; $i, 1, -1, 1$ ;	
	$R_8$ ; 1; $-i, 1, -1, 1$ ;	
	$R_9$ ; 2; $-\sigma_1, -\sigma_0, \sigma_3, -i\sigma_3$ ;	QNL; 0
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, IT$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, $-1, 1$ ;	
	$R_3$ ; 1; $-1, 1, 1$ ;	
	$R_4$ ; 1; $-1, -1, 1$ ;	
$S$ ; ZA; $C_{2a}, \sigma_z, IT$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, $-1, 1$ ;	
	$R_3$ ; 1; $-1, 1, 1$ ;	
	$R_4$ ; 1; $-1, -1, 1$ ;	
$Y$ ; XM; $\sigma_y, C_{2x}, IT$ ;	$R_5$ ; 2; $\sigma_2, \sigma_3, -i\sigma_1$ ;	WNL; $\pi$
$T$ ; RA; $\sigma_y, C_{2x}, IT$ ;	$R_5$ ; 2; $\sigma_2, \sigma_3, -i\sigma_1$ ;	WNL; $\pi$
$W$ ; XR; $\sigma_y, C_{2z}, IT$ ;	$R_5$ ; 2; $\sigma_2, \sigma_3, -i\sigma_1$ ;	WNL; $\pi$

$\Gamma_q; \{C_{4z}^+|\frac{1}{2}\frac{1}{2}0\}, \{C_{2x}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1;		
	$R_3;$	1; -1, 1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
	$R_6;$	1; 1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, 1, -1, 1;		
	$R_9;$	1; -1, -1, -1, 1;		
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$Z; (00\frac{1}{2}); I, \sigma_{db}, C_{4z}^+, \mathcal{T};$	$R_{10};$	2; $-\sigma_3, i\sigma_2, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-\sigma_3, i\sigma_2, -\sigma_0, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$\{R_{12}, R_{13}\};$		4; $-\Gamma_{0,3}, i\Gamma_{0,2}, -i\Gamma_{3,3}, \Gamma_{1,0};$	QDP; 0
	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_y, C_{2y}, C_{2x}, \mathcal{T};$	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
$X; (0\frac{1}{2}0); \sigma_x, \sigma_y, C_{2y}, \mathcal{T};$	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
	$R_1;$	1; 1, 1, 1;		
$U; ZR; \sigma_z, C_{2y}, I\mathcal{T};$	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$	
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$V; MA; C_{4z}^+, C_{2z}, \sigma_{da}, I\mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL; 0	
	$R_5;$	1; $-i, 1, 1, 1;$		
	$R_6;$	1; $i, 1, 1, 1;$		
	$R_7;$	1; $i, 1, -1, 1;$		
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_8;$	1; $-i, 1, -1, 1;$		
	$R_9;$	2; $-\sigma_1, -\sigma_0, \sigma_3, -i\sigma_3;$	QNL; 0	
	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
$S; ZA; \sigma_z, C_{2a}, I\mathcal{T};$	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$	
	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$	



$$\begin{aligned} T; \text{ RA}; \sigma_y, C_{2x}, I\mathcal{T}; R_2; 1; -i, 1, 1; \\ R_4; 1; i, 1, 1; \\ R_6; 1; -i, -1, 1; \\ R_8; 1; i, -1, 1; \\ W; \text{ XR}; \sigma_y, C_{2z}, I\mathcal{T}; R_5; 2; \sigma_2, \sigma_3, -i\sigma_1; \text{ WNL}; \pi \end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; 1, -1, 1, 1;	
	$R_3;$	1; -1, 1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
	$R_6;$	1; 1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, 1, -1, 1;	
	$R_9;$	1; -1, -1, -1, 1;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$M; (\frac{1}{2} \frac{1}{2} 0); C_{2x}, C_{2z}, \sigma_{db}, I, \mathcal{T}; \{R_5, R_6\};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$R_{10};$	2; $i\sigma_2, -\sigma_0, \sigma_3, \sigma_0, -\sigma_0;$	P-NSs;
	$\{R_{15}, R_{16}\};$	2; $i\sigma_3, \sigma_0, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$\{R_{17}, R_{18}\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$R_{20};$	2; $i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0, -\sigma_0;$	P-NSs;
$Z; (00 \frac{1}{2}); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; 1, -1, 1, 1;	
	$R_3;$	1; -1, 1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
	$R_6;$	1; 1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, 1, -1, 1;	
	$R_9;$	1; -1, -1, -1, 1;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{2x}, C_{2z}, \sigma_{db}, I, \mathcal{T}; \{R_5, R_6\};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$R_{10};$	2; $i\sigma_2, -\sigma_0, \sigma_3, \sigma_0, -\sigma_0;$	P-NSs;
	$\{R_{15}, R_{16}\};$	2; $i\sigma_3, \sigma_0, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$\{R_{17}, R_{18}\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$R_{20};$	2; $i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0, -\sigma_0;$	P-NSs;
$R; (0 \frac{1}{2} \frac{1}{2}); \sigma_x, \sigma_y, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX}$ ;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX}$ ;
$X; (0 \frac{1}{2} 0); \sigma_x, \sigma_y, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX}$ ;
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX}$ ;
$\Delta; \Gamma X; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$U; ZR; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ;	$R_1$ ;	1; 1, 1, 1;		
	$R_2$ ;	1; 1, -1, 1;		
	$R_3$ ;	1; -1, 1, 1;		
	$R_4$ ;	1; -1, -1, 1;		
	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	QNL;	0
$V$ ; MA; $\sigma_x, C_{2z}, \sigma_{da}, IT$ ;	$\{R_5, R_6\}$ ;	2; $-i\sigma_3, \sigma_0, \sigma_0, \sigma_1$ ;	L-NSs;	
	$\{R_7, R_8\}$ ;	2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_1$ ;	L-NSs;	
	$R_{10}$ ;	2; $-i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0$ ;	L-NSs;	
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, IT$ ;	$R_1$ ;	1; 1, 1, 1;		
	$R_2$ ;	1; 1, -1, 1;		
	$R_3$ ;	1; -1, 1, 1;		
	$R_4$ ;	1; -1, -1, 1;		
$S$ ; ZA; $C_{2a}, \sigma_z, IT$ ;	$R_1$ ;	1; 1, 1, 1;		
	$R_2$ ;	1; 1, -1, 1;		
	$R_3$ ;	1; -1, 1, 1;		
	$R_4$ ;	1; -1, -1, 1;		
$Y$ ; XM; $\sigma_y, \sigma_z, IT$ ;	$\{R_2, R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>MARX</sub> ;	
	$\{R_6, R_8\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>MARX</sub> ;	
$T$ ; RA; $\sigma_y, \sigma_z, IT$ ;	$\{R_2, R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_1$ ;	L-NS <sub>MARX</sub> ;	
	$\{R_6, R_8\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>MARX</sub> ;	
$W$ ; XR; $\sigma_y, C_{2z}, IT$ ;	$R_5$ ;	2; $\sigma_2, \sigma_3, -\sigma_0$ ;	L-NS <sub>MARX</sub> ;	

SG 128

 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 00 \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1;		
	$R_3;$	1; -1, 1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;	
	$R_6;$	1; 1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, 1, -1, 1;		
	$R_9;$	1; -1, -1, -1, 1;		
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;	
$M; (\frac{1}{2} \frac{1}{2} 0); C_{2x}, C_{2z}, \sigma_{db}, I, \mathcal{T}; \{R_5, R_6\};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_0, \sigma_1;$	P-NSs;	
	$R_{10};$	2; $i\sigma_2, -\sigma_0, \sigma_3, \sigma_0, -\sigma_0;$	P-NSs;	
	$\{R_{15}, R_{16}\};$	2; $i\sigma_3, \sigma_0, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;	
	$\{R_{17}, R_{18}\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, -\sigma_0, \sigma_1;$	P-NSs;	
	$R_{20};$	2; $i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0, -\sigma_0;$	P-NSs;	
	$\{R_{12}, R_{13}\};$	4; $-\Gamma_{0,3}, i\Gamma_{0,2}, -i\Gamma_{3,3}, \Gamma_{1,0};$	QDP;	0
$Z; (00 \frac{1}{2}); I, \sigma_{db}, C_{4z}^+, \mathcal{T};$	$R_{10};$	2; $-\sigma_3, i\sigma_2, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-\sigma_3, i\sigma_2, -\sigma_0, -\sigma_0;$	P-WNLs;	
	$\{R_{12}, R_{13}\};$	4; $-\Gamma_{0,3}, i\Gamma_{0,2}, -i\Gamma_{3,3}, \Gamma_{1,0};$	QDP;	0
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); I, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$R_{10};$	2; $-\sigma_3, i\sigma_2, \sigma_0, -\sigma_0;$	P-NSs;	
	$R_{11};$	2; $-\sigma_3, i\sigma_2, -\sigma_0, -\sigma_0;$	P-NSs;	
	$\{R_{12}, R_{13}\};$	4; $-\Gamma_{0,3}, i\Gamma_{0,2}, -i\Gamma_{3,3}, \Gamma_{1,0};$	QDP;	0
$R; (0 \frac{1}{2} \frac{1}{2}); C_{2y}, C_{2z}, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNL/NS;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNL/NS;	
$X; (0 \frac{1}{2} 0); \sigma_x, \sigma_y, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX}$ ;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX}$ ;	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$U; ZR; \sigma_z, C_{2y}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
$V; MA; \sigma_x, C_{2z}, \sigma_{da}, I\mathcal{T};$	$\{R_5, R_6\};$	2; $-i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	L-NSs;	
	$\{R_7, R_8\};$	2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	L-NSs;	
	$R_{10};$	2; $-i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0;$	L-NSs;	
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$S; ZA; \sigma_z, C_{2a}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$Y; XM; \sigma_y, \sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_0, \sigma_1;$	L-NS $_{MARX}$ ;	
	$\{R_6, R_8\};$	2; $\sigma_3, -\sigma_0, \sigma_1;$	L-NS $_{MARX}$ ;	

$T$ ; RA;  $C_{2x}, \sigma_y, I\mathcal{T}$ ;  $R_5$ ; 2;  $\sigma_2, -i\sigma_1, -i\sigma_3$ ; L-NS<sub>MARX</sub>;  
 $W$ ; XR;  $\sigma_y, C_{2z}, I\mathcal{T}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -\sigma_0$ ; L-NS<sub>MARX</sub>;

$\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; 1, -1, 1, 1;$	
	$R_3; 1; -1, 1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
	$R_6; 1; 1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, 1, -1, 1;$	
	$R_9; 1; -1, -1, -1, 1;$	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T};$	$R_9; 2; \sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
	$R_{11}; 2; -i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
	$R_{12}; 2; -\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
	$R_{14}; 2; -i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
$Z; (00\frac{1}{2}); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; 1, -1, 1, 1;$	
	$R_3; 1; -1, 1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
	$R_6; 1; 1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, 1, -1, 1;$	
	$R_9; 1; -1, -1, -1, 1;$	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T};$	$R_9; 2; \sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
	$R_{11}; 2; -i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
	$R_{12}; 2; -\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
	$R_{14}; 2; -i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
$R; (0\frac{1}{2}\frac{1}{2}); C_{2y}, C_{2x}, \sigma_x, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX}$ ;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX}$ ;
$X; (0\frac{1}{2}0); C_{2y}, C_{2x}, \sigma_x, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX}$ ;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX}$ ;
$\Delta; \Gamma X; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$U; ZR; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	QNL; 0

$$\begin{aligned}
V; \text{ MA}; C_{4z, \sigma_y, IT}^+; \{R_1, R_4\}; 2; \sigma_3, \sigma_3, \sigma_1; & \text{ L-NS}_{MARX}; \\
& \{R_2, R_3\}; 2; \sigma_3, -\sigma_3, \sigma_1; \text{ L-NS}_{MARX}; \\
& R_5; 2; i\sigma_2, \sigma_3, -i\sigma_1; \text{ L-NS}_{MARX}; \\
\Sigma; \text{ GM}; C_{2a, \sigma_z, IT}; R_1; & 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 1; -1, 1, 1; \\
& R_4; 1; -1, -1, 1; \\
S; \text{ ZA}; C_{2a, \sigma_z, IT}; R_1; & 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 1; -1, 1, 1; \\
& R_4; 1; -1, -1, 1; \\
Y; \text{ XM}; C_{2x, \sigma_y, IT}; R_5; & 2; \sigma_2, \sigma_3, -i\sigma_1; \text{ L-NS}_{MARX}; \\
T; \text{ RA}; C_{2x, \sigma_y, IT}; R_5; & 2; \sigma_2, \sigma_3, -i\sigma_1; \text{ L-NS}_{MARX}; \\
W; \text{ XR}; C_{2z, \sigma_y, IT}; \{R_1, R_4\}; 2; \sigma_3, \sigma_3, \sigma_1; & \text{ L-NS}_{MARX}; \\
& \{R_2, R_3\}; 2; \sigma_3, -\sigma_3, \sigma_1; \text{ L-NS}_{MARX};
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1;		
	$R_3;$	1; -1, 1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
	$R_6;$	1; 1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, 1, -1, 1;		
	$R_9;$	1; -1, -1, -1, 1;		
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
$Z; (00\frac{1}{2}); I, \sigma_{db}, C_{4z}^+, \mathcal{T};$	$R_{10};$	2; $-\sigma_3, i\sigma_2, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-\sigma_3, i\sigma_2, -\sigma_0, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2x}, C_{4z}^+, I, \mathcal{T};$	$\{R_{12}, R_{13}\};$	4; $-\Gamma_{0,3}, i\Gamma_{0,2}, -i\Gamma_{3,3}, \Gamma_{1,0};$	QDP;	0
	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,3}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	QDP;	0
	$\{R_{13}, R_{14}\};$	4; $i\Gamma_{3,0}, i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{1,0};$	QDP;	0
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_y, C_{2x}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	DP;	0
$X; (0\frac{1}{2}0); C_{2y}, C_{2x}, \sigma_x, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX};$	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX};$	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$U; ZR; \sigma_z, C_{2y}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
$V; MA; C_{4z}^+, \sigma_y, I\mathcal{T};$	$\{R_1, R_4\};$	2; $\sigma_3, \sigma_3, \sigma_1;$	L-NS $_{MARX};$	
	$\{R_2, R_3\};$	2; $\sigma_3, -\sigma_3, \sigma_1;$	L-NS $_{MARX};$	
	$R_5;$	2; $i\sigma_2, \sigma_3, -i\sigma_1;$	L-NS $_{MARX};$	
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$S; ZA; \sigma_z, C_{2a}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$Y; XM; C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	L-NS $_{MARX};$	
$T; RA; C_{2x}, \sigma_y, I\mathcal{T};$	$\{R_2, R_8\};$	2; $\sigma_3, -i\sigma_3, \sigma_1;$	L-NS $_{MARX};$	
	$\{R_4, R_6\};$	2; $-\sigma_3, -i\sigma_3, \sigma_1;$	L-NS $_{MARX};$	
$W; XR; C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_1, R_4\};$	2; $\sigma_3, \sigma_3, \sigma_1;$	L-NS $_{MARX};$	
	$\{R_2, R_3\};$	2; $\sigma_3, -\sigma_3, \sigma_1;$	L-NS $_{MARX};$	



SG 131

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{C_{2x}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; 1, -1, 1, 1;	
	$R_3;$	1; -1, 1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
	$R_6;$	1; 1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, 1, -1, 1;	
	$R_9;$	1; -1, -1, -1, 1;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; 1, -1, 1, 1;	
	$R_3;$	1; -1, 1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{MA}$ ;
	$R_6;$	1; 1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, 1, -1, 1;	
	$R_9;$	1; -1, -1, -1, 1;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{MA}$ ;
$Z; (00\frac{1}{2}); C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; -1, 1, 1, 1;	
	$R_3;$	1; 1, -1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	1; 1, 1, -1, 1;	
	$R_6;$	1; -1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, -1, -1, 1;	

$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$
	$R_2; 1; -1, 1, 1, 1;$
	$R_3; 1; 1, -1, 1, 1;$
	$R_4; 1; -1, -1, 1, 1;$
	$R_5; 1; 1, 1, -1, 1;$
	$R_6; 1; -1, 1, -1, 1;$
	$R_7; 1; 1, -1, -1, 1;$
	$R_8; 1; -1, -1, -1, 1;$
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$U; ZR; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
	$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0; \text{ QNL; } 0$
$V; MA; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
	$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0; \text{ QNL; } 0$
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$S; ZA; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -\sigma_0; \text{ WNL; } \pi$
$Y; XM; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$T; RA; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$
$W; XR; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
	$R_2; 1; 1, -1, 1;$
	$R_3; 1; -1, 1, 1;$
	$R_4; 1; -1, -1, 1;$

SG 132

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{C_{2x}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; 1, -1, 1, 1;$	
	$R_3; 1; -1, 1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
	$R_6; 1; 1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, 1, -1, 1;$	
	$R_9; 1; -1, -1, -1, 1;$	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; 1, -1, 1, 1;$	
	$R_3; 1; -1, 1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{MA}$ ;
	$R_6; 1; 1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, 1, -1, 1;$	
	$R_9; 1; -1, -1, -1, 1;$	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{MA}$ ;
$Z; (00\frac{1}{2}); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_9; 2; \sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{11}; 2; -i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{12}; 2; -\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{14}; 2; -i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_9; 2; \sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{11}; 2; -i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{12}; 2; -\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{14}; 2; -i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_x, C_{2y}, C_{2z}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; -1, 1, 1, 1;$	
	$R_3; 1; 1, -1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 1; 1, 1, -1, 1;$	
	$R_6; 1; -1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, -1, -1, 1;$	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$U; ZR; \sigma_z, C_{2y}, I, \mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	WNL; $\pi$

$$\begin{aligned}
\Lambda; \Gamma Z; C_{4z, \sigma_y, I\mathcal{T}}^+; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
R_5; 2; i\sigma_2, \sigma_3, -\sigma_0; \text{QNL}; 0 \\
V; \text{MA}; C_{4z, \sigma_y, I\mathcal{T}}^+; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
R_5; 2; i\sigma_2, \sigma_3, -\sigma_0; \text{QNL}; 0 \\
\Sigma; \Gamma M; C_{2a, \sigma_z, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
S; \text{ZA}; C_{2a, \sigma_{db}, I\mathcal{T}}; R_2; 1; 1, 1, 1; \\
R_4; 1; -1, 1, 1; \\
R_6; 1; 1, -1, 1; \\
R_8; 1; -1, -1, 1; \\
Y; \text{XM}; C_{2x, \sigma_z, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1; \\
T; \text{RA}; \sigma_z, C_{2x, I\mathcal{T}}; R_5; 2; \sigma_2, \sigma_3, -i\sigma_1; \text{WNL}; \pi \\
W; \text{XR}; C_{2z, \sigma_y, I\mathcal{T}}; R_1; 1; 1, 1, 1; \\
R_2; 1; 1, -1, 1; \\
R_3; 1; -1, 1, 1; \\
R_4; 1; -1, -1, 1;
\end{aligned}$$

SG 133

 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1;		
	$R_3;$	1; -1, 1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
	$R_6;$	1; 1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, 1, -1, 1;		
	$R_9;$	1; -1, -1, -1, 1;		
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$Z; (00 \frac{1}{2}); C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); I, \sigma_x, C_{4z}^+, \mathcal{T};$	$R_{10};$	2; $-\sigma_3, i\sigma_2, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-\sigma_3, i\sigma_2, -\sigma_0, -\sigma_0;$	P-WNLs;	
	$\{R_{12}, R_{13}\};$		4; $-\Gamma_{0,3}, i\Gamma_{0,2}, -i\Gamma_{3,3}, \Gamma_{1,0};$	QDP; 0
$R; (0 \frac{1}{2} \frac{1}{2}); \sigma_x, \sigma_y, C_{2y}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$X; (0 \frac{1}{2} 0); \sigma_x, \sigma_y, C_{2y}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$U; ZR; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
$V; MA; C_{4z}^+, C_{2z}, \sigma_{da}, I\mathcal{T};$	$R_5;$	1; $-i, 1, 1, 1;$		
	$R_6;$	1; $i, 1, 1, 1;$		
	$R_7;$	1; $i, 1, -1, 1;$		
	$R_8;$	1; $-i, 1, -1, 1;$		
	$R_9;$	2; $-\sigma_1, -\sigma_0, \sigma_3, -i\sigma_3;$	QNL;	0

$\Sigma$ ;  $\Gamma\text{M}$ ;  $C_{2a,\sigma_z,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $S$ ;  $\text{ZA}$ ;  $C_{2a,\sigma_z,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -\sigma_0$ ; WNL;  $\pi$   
 $Y$ ;  $\text{XM}$ ;  $\sigma_y, C_{2x,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $T$ ;  $\text{RA}$ ;  $\sigma_y, C_{2x,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$   
 $W$ ;  $\text{XR}$ ;  $\sigma_y, C_{2z,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -i\sigma_1$ ; WNL;  $\pi$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1;		
	$R_3;$	1; -1, 1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
	$R_6;$	1; 1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, 1, -1, 1;		
	$R_9;$	1; -1, -1, -1, 1;		
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$Z; (00 \frac{1}{2}); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1;		
	$R_3;$	1; -1, 1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{MA};$	
	$R_6;$	1; 1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, 1, -1, 1;		
	$R_9;$	1; -1, -1, -1, 1;		
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{MA};$	
$R; (0 \frac{1}{2} \frac{1}{2}); \sigma_y, C_{2y}, C_{2x}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$X; (0 \frac{1}{2} 0); \sigma_x, \sigma_y, C_{2y}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$U; ZR; \sigma_z, C_{2y}, I, \mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0

$V$ ; MA; $C_{4z}^+, C_{2z}, \sigma_{da}, IT$ ;	$R_5$ ; 1; $-i, 1, 1, 1$ ;	
	$R_6$ ; 1; $i, 1, 1, 1$ ;	
	$R_7$ ; 1; $i, 1, -1, 1$ ;	
	$R_8$ ; 1; $-i, 1, -1, 1$ ;	
	$R_9$ ; 2; $-\sigma_1, -\sigma_0, \sigma_3, -i\sigma_3$ ;	QNL; 0
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, IT$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, $-1, 1$ ;	
	$R_3$ ; 1; $-1, 1, 1$ ;	
	$R_4$ ; 1; $-1, -1, 1$ ;	
$S$ ; ZA; $C_{2a}, \sigma_{db}, IT$ ;	$R_2$ ; 1; 1, 1, 1;	
	$R_4$ ; 1; $-1, 1, 1$ ;	
	$R_6$ ; 1; 1, $-1, 1$ ;	
	$R_8$ ; 1; $-1, -1, 1$ ;	
$Y$ ; XM; $\sigma_y, C_{2x}, IT$ ;	$R_5$ ; 2; $\sigma_2, \sigma_3, -i\sigma_1$ ;	WNL; $\pi$
$T$ ; RA; $\sigma_y, C_{2x}, IT$ ;	$R_2$ ; 1; $-i, 1, 1$ ;	
	$R_4$ ; 1; $i, 1, 1$ ;	
	$R_6$ ; 1; $-i, -1, 1$ ;	
	$R_8$ ; 1; $i, -1, 1$ ;	
$W$ ; XR; $\sigma_y, C_{2z}, IT$ ;	$R_5$ ; 2; $\sigma_2, \sigma_3, -i\sigma_1$ ;	WNL; $\pi$



SG 135

 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1;		
	$R_3;$	1; -1, 1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
	$R_6;$	1; 1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, 1, -1, 1;		
	$R_9;$	1; -1, -1, -1, 1;		
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2} \frac{1}{2} 0); C_{2x}, C_{2z}, \sigma_{db}, I, \mathcal{T}; \{R_5, R_6\};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_0, \sigma_1;$	P-NSs;	
	$R_{10};$	2; $i\sigma_2, -\sigma_0, \sigma_3, \sigma_0, -\sigma_0;$	P-NSs;	
	$\{R_{15}, R_{16}\};$	2; $i\sigma_3, \sigma_0, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;	
	$\{R_{17}, R_{18}\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, -\sigma_0, \sigma_1;$	P-NSs;	
	$R_{20};$	2; $i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0, -\sigma_0;$	P-NSs;	
$Z; (00\frac{1}{2}); C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{2x}, C_{4z}^+, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,3}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	QDP;	0
	$\{R_{13}, R_{14}\};$	4; $i\Gamma_{3,0}, i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{1,0};$	QDP;	0
$R; (0\frac{1}{2} \frac{1}{2}); \sigma_x, \sigma_y, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX};$	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX};$	
$X; (0\frac{1}{2} 0); \sigma_x, \sigma_y, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX};$	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX};$	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$U; ZR; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$V; MA; \sigma_x, C_{2z}, \sigma_{da}, I\mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
	$\{R_5, R_6\};$	2; $-i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	L-NSs;	
	$\{R_7, R_8\};$	2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	L-NSs;	
	$R_{10};$	2; $-i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0;$	L-NSs;	

$\Sigma$ ;  $\Gamma\text{M}$ ;  $C_{2a,\sigma_z,IT}$ ;  $R_1$ ; 1; 1, 1, 1;  
 $R_2$ ; 1; 1, -1, 1;  
 $R_3$ ; 1; -1, 1, 1;  
 $R_4$ ; 1; -1, -1, 1;  
 $S$ ;  $\text{ZA}$ ;  $C_{2a,\sigma_z,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -\sigma_0$ ; WNL;  $\pi$   
 $Y$ ;  $\text{XM}$ ;  $C_{2x,\sigma_z,IT}$ ;  $\{R_2, R_4\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_1$ ; L-NS<sub>MARX</sub>;  
 $\{R_6, R_8\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_1$ ; L-NS<sub>MARX</sub>;  
 $T$ ;  $\text{RA}$ ;  $C_{2x,\sigma_z,IT}$ ;  $\{R_2, R_4\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_1$ ; L-NS<sub>MARX</sub>;  
 $\{R_6, R_8\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_1$ ; L-NS<sub>MARX</sub>;  
 $W$ ;  $\text{XR}$ ;  $\sigma_y, C_{2z,IT}$ ;  $R_5$ ; 2;  $\sigma_2, \sigma_3, -\sigma_0$ ; L-NS<sub>MARX</sub>;

SG 136

 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 00 \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1;		
	$R_3;$	1; -1, 1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
	$R_6;$	1; 1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, 1, -1, 1;		
	$R_9;$	1; -1, -1, -1, 1;		
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2} \frac{1}{2} 0); C_{2x}, C_{2z}, \sigma_{db}, I, \mathcal{T}; \{R_5, R_6\};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_0, \sigma_1;$	P-NSs;	
	$R_{10};$	2; $i\sigma_2, -\sigma_0, \sigma_3, \sigma_0, -\sigma_0;$	P-NSs;	
	$\{R_{15}, R_{16}\};$	2; $i\sigma_3, \sigma_0, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;	
	$\{R_{17}, R_{18}\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, -\sigma_0, \sigma_1;$	P-NSs;	
	$R_{20};$	2; $i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0, -\sigma_0;$	P-NSs;	
$Z; (00 \frac{1}{2}); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
$R; (0 \frac{1}{2} \frac{1}{2}); C_{2y}, C_{2z}, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NSs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NSs;	
$X; (0 \frac{1}{2} 0); \sigma_x, \sigma_y, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX};$	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX};$	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$U; ZR; \sigma_z, C_{2y}, I \mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
$V; MA; \sigma_x, C_{2z}, \sigma_{da}, I \mathcal{T};$	$\{R_5, R_6\};$	2; $-i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	L-NSs;	
	$\{R_7, R_8\};$	2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	L-NSs;	
	$R_{10};$	2; $-i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0;$	L-NSs;	

$\Sigma$ ; $\Gamma\text{M}$ ; $C_{2a,\sigma_z,IT}$ ; $R_1$ ;	$1; 1, 1, 1;$
	$R_2$ ; $1; 1, -1, 1;$
	$R_3$ ; $1; -1, 1, 1;$
	$R_4$ ; $1; -1, -1, 1;$
$S$ ; $\text{ZA}$ ; $C_{2a,\sigma_{ab},IT}$ ; $R_2$ ;	$1; 1, 1, 1;$
	$R_4$ ; $1; -1, 1, 1;$
	$R_6$ ; $1; 1, -1, 1;$
	$R_8$ ; $1; -1, -1, 1;$
$Y$ ; $\text{XM}$ ; $C_{2x,\sigma_z,IT}$ ; $\{R_2, R_4\}$ ; $2; \sigma_3, \sigma_0, \sigma_1$ ;	$\text{L-NS}_{\text{MARX}};$
	$\{R_6, R_8\}; 2; \sigma_3, -\sigma_0, \sigma_1; \text{L-NS}_{\text{MARX}};$
$T$ ; $\text{RA}$ ; $C_{2x,\sigma_z,IT}$ ; $R_5$ ;	$2; \sigma_2, \sigma_1, -i\sigma_1; \text{L-NS}_{\text{MARX}};$
$W$ ; $\text{XR}$ ; $\sigma_y, C_{2z,IT}$ ; $R_5$ ;	$2; \sigma_2, \sigma_3, -\sigma_0; \text{L-NS}_{\text{MARX}};$

SG 137

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; 1, -1, 1, 1;	
	$R_3;$	1; -1, 1, 1, 1;	
	$R_4;$	1; -1, -1, 1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$
	$R_6;$	1; 1, 1, -1, 1;	
	$R_7;$	1; 1, -1, -1, 1;	
	$R_8;$	1; -1, 1, -1, 1;	
	$R_9;$	1; -1, -1, -1, 1;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;
$Z; (00\frac{1}{2}); C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); I, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$R_{10};$	2; $-\sigma_3, i\sigma_2, \sigma_0, -\sigma_0;$	P-NSs;
	$R_{11};$	2; $-\sigma_3, i\sigma_2, -\sigma_0, -\sigma_0;$	P-NSs;
	$\{R_{12}, R_{13}\};$	4; $-\Gamma_{0,3}, i\Gamma_{0,2}, -i\Gamma_{3,3}, \Gamma_{1,0};$	QDP; 0
$R; (0\frac{1}{2}\frac{1}{2}); C_{2y}, C_{2x}, \sigma_x, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX};$
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX};$
$X; (0\frac{1}{2}0); C_{2y}, C_{2x}, \sigma_x, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX};$
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX};$
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$U; ZR; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL; 0
$V; MA; C_{4z}^+, \sigma_y, I\mathcal{T};$	$\{R_1, R_4\};$	2; $\sigma_3, \sigma_3, \sigma_1;$	L-NS $_{MARX};$
	$\{R_2, R_3\};$	2; $\sigma_3, -\sigma_3, \sigma_1;$	L-NS $_{MARX};$
	$R_5;$	2; $i\sigma_2, \sigma_3, -i\sigma_1;$	L-NS $_{MARX};$
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	

$$\begin{array}{llll} S; & \text{ZA}; & C_{2a,\sigma_z,IT}; & R_5; & 2; & \sigma_2, \sigma_3, -\sigma_0; & \text{WNL}; & \pi \\ Y; & \text{XM}; & C_{2x,\sigma_z,IT}; & R_5; & 2; & \sigma_2, -i\sigma_3, -i\sigma_3; & \text{L-NS}_{MARX}; \\ T; & \text{RA}; & C_{2x,\sigma_z,IT}; & R_5; & 2; & \sigma_2, -i\sigma_3, -i\sigma_3; & \text{L-NS}_{MARX}; \\ W; & \text{XR}; & C_{2z,\sigma_y,IT}; & \{R_1, R_4\}; & 2; & \sigma_3, \sigma_3, \sigma_1; & \text{L-NS}_{MARX}; \\ & & & \{R_2, R_3\}; & 2; & \sigma_3, -\sigma_3, \sigma_1; & \text{L-NS}_{MARX}; \end{array}$$

$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1;		
	$R_3;$	1; -1, 1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
	$R_6;$	1; 1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, 1, -1, 1;		
	$R_9;$	1; -1, -1, -1, 1;		
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-NSs;	
$Z; (00 \frac{1}{2}); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{2x}, C_{2z}, \sigma_{db}, I, \mathcal{T}; \{R_5, R_6\};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_0, \sigma_1;$	P-NSs;	
	$R_{10};$	2; $i\sigma_2, -\sigma_0, \sigma_3, \sigma_0, -\sigma_0;$	P-NSs;	
	$\{R_{15}, R_{16}\};$	2; $i\sigma_3, \sigma_0, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;	
	$\{R_{17}, R_{18}\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, -\sigma_0, \sigma_1;$	P-NSs;	
	$R_{20};$	2; $i\sigma_2, -\sigma_0, \sigma_3, -\sigma_0, -\sigma_0;$	P-NSs;	
	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	DP;	0
$R; (0 \frac{1}{2} \frac{1}{2}); \sigma_y, C_{2x}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	DP;	0
$X; (0 \frac{1}{2} 0); C_{2y}, C_{2x}, \sigma_x, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{MARX};$	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{MARX};$	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$U; ZR; \sigma_z, C_{2y}, I, \mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
$V; MA; C_{4z}^+, \sigma_y, I, \mathcal{T};$	$\{R_1, R_4\};$	2; $\sigma_3, \sigma_3, \sigma_1;$	L-NS $_{MARX};$	
	$\{R_2, R_3\};$	2; $\sigma_3, -\sigma_3, \sigma_1;$	L-NS $_{MARX};$	
	$R_5;$	2; $i\sigma_2, \sigma_3, -i\sigma_1;$	L-NS $_{MARX};$	
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		

$$\begin{aligned}
S; \text{ ZA}; C_{2a, \sigma_{db}, IT}; R_2; & \quad 1; 1, 1, 1; \\
& R_4; \quad 1; -1, 1, 1; \\
& R_6; \quad 1; 1, -1, 1; \\
& R_8; \quad 1; -1, -1, 1; \\
Y; \text{ XM}; C_{2x, \sigma_z, IT}; R_5; & \quad 2; \sigma_2, -i\sigma_3, -i\sigma_3; \text{ L-NS}_{MARX}; \\
T; \text{ RA}; C_{2x, \sigma_y, IT}; \{R_2, R_8\}; & \quad 2; \sigma_3, -i\sigma_3, \sigma_1; \quad \text{ L-NS}_{MARX}; \\
& \{R_4, R_6\}; 2; -\sigma_3, -i\sigma_3, \sigma_1; \quad \text{ L-NS}_{MARX}; \\
W; \text{ XR}; C_{2z, \sigma_y, IT}; \{R_1, R_4\}; & \quad 2; \sigma_3, \sigma_3, \sigma_1; \quad \text{ L-NS}_{MARX}; \\
& \{R_2, R_3\}; 2; \sigma_3, -\sigma_3, \sigma_1; \quad \text{ L-NS}_{MARX};
\end{aligned}$$



SG 139

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
		$R_2;$	1; 1, -1, 1, 1;	
		$R_3;$	1; -1, 1, 1, 1;	
		$R_4;$	1; -1, -1, 1, 1;	
		$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
		$R_6;$	1; 1, 1, -1, 1;	
		$R_7;$	1; 1, -1, -1, 1;	
		$R_8;$	1; -1, 1, -1, 1;	
		$R_9;$	1; -1, -1, -1, 1;	
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$N; (0\frac{1}{2}0);$	$C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
$X; (00\frac{1}{2});$	$C_{2z}, C_{2a}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
		$R_2;$	1; -1, 1, 1, 1;	
		$R_3;$	1; 1, -1, 1, 1;	
		$R_4;$	1; -1, -1, 1, 1;	
		$R_5;$	1; 1, 1, -1, 1;	
		$R_6;$	1; -1, 1, -1, 1;	
		$R_7;$	1; 1, -1, -1, 1;	
		$R_8;$	1; -1, -1, -1, 1;	
$Z; (\bar{1}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
		$R_2;$	1; 1, -1, 1, 1;	
		$R_3;$	1; -1, 1, 1, 1;	
		$R_4;$	1; -1, -1, 1, 1;	
		$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
		$R_6;$	1; 1, 1, -1, 1;	
		$R_7;$	1; 1, -1, -1, 1;	
		$R_8;$	1; -1, 1, -1, 1;	
		$R_9;$	1; -1, -1, -1, 1;	
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z}$ ;
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; -1, -1, 1;	
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL; 0

$V; \text{ ZV};$	$C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
		$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0; \text{ QNL}; 0$
$W; \text{ XP};$	$C_{2z}, \sigma_{db}, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$\Sigma; \text{ } \Gamma\text{Z}/\Gamma\Sigma;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$F; \text{ ZF};$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$Q; \text{ NP};$	$C_{2y}, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; -1, 1, 1;$
$\Delta; \text{ } \Gamma\text{X};$	$C_{2a}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$U; \text{ ZU};$	$C_{2a}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$
$Y; \text{ XZ/XY};$	$C_{2b}, \sigma_{da}, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$
		$R_2; 1; 1, -1, 1;$
		$R_3; 1; -1, 1, 1;$
		$R_4; 1; -1, -1, 1;$

SG 140

 $\Gamma_q^v; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
		$R_2;$	1; 1, -1, 1, 1;		
		$R_3;$	1; -1, 1, 1, 1;		
		$R_4;$	1; -1, -1, 1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
		$R_6;$	1; 1, 1, -1, 1;		
		$R_7;$	1; 1, -1, -1, 1;		
		$R_8;$	1; -1, 1, -1, 1;		
		$R_9;$	1; -1, -1, -1, 1;		
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, C_{2y}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (00\frac{1}{2});$	$C_{2z}, C_{2a}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
		$R_2;$	1; -1, 1, 1, 1;		
		$R_3;$	1; 1, -1, 1, 1;		
		$R_4;$	1; -1, -1, 1, 1;		
		$R_5;$	1; 1, 1, -1, 1;		
		$R_6;$	1; -1, 1, -1, 1;		
		$R_7;$	1; 1, -1, -1, 1;		
		$R_8;$	1; -1, -1, -1, 1;		
$Z; (\bar{1}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
		$R_2;$	1; 1, -1, 1, 1;		
		$R_3;$	1; -1, 1, 1, 1;		
		$R_4;$	1; -1, -1, 1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
		$R_6;$	1; 1, 1, -1, 1;		
		$R_7;$	1; 1, -1, -1, 1;		
		$R_8;$	1; -1, 1, -1, 1;		
		$R_9;$	1; -1, -1, -1, 1;		
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, C_{2x}, I\mathcal{T};$	$\{R_1, R_4\};$	2; $\sigma_3, \sigma_3, \sigma_1;$	P-WNLs;	
		$\{R_2, R_3\};$	2; $\sigma_3, -\sigma_3, \sigma_1;$	P-WNLs;	
		$R_5;$	2; $i\sigma_2, \sigma_3, -i\sigma_1;$	P-WNLs;	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
$V; ZV;$	$C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0

$W; \text{XP};$	$C_{2z, \sigma_{db}, I\mathcal{T}};$	$R_1;$	$1; 1, 1, 1;$
		$R_2;$	$1; 1, -1, 1;$
		$R_3;$	$1; -1, 1, 1;$
		$R_4;$	$1; -1, -1, 1;$
$\Sigma; \Gamma\text{Z}/\Gamma\Sigma;$	$C_{2x, \sigma_z, I\mathcal{T}};$	$R_1;$	$1; 1, 1, 1;$
		$R_2;$	$1; 1, -1, 1;$
		$R_3;$	$1; -1, 1, 1;$
		$R_4;$	$1; -1, -1, 1;$
$F; \text{ZF};$	$C_{2x, \sigma_z, I\mathcal{T}};$	$R_1;$	$1; 1, -1, 1;$
		$R_2;$	$1; 1, 1, 1;$
		$R_3;$	$1; -1, -1, 1;$
		$R_4;$	$1; -1, 1, 1;$
$Q; \text{NP};$	$C_{2y, I\mathcal{T}};$	$\{R_1, R_2\};$	$2; \sigma_3, \sigma_1; \quad \text{WNL}; \pi$
$\Delta; \Gamma\text{X};$	$C_{2a, \sigma_z, I\mathcal{T}};$	$R_1;$	$1; 1, 1, 1;$
		$R_2;$	$1; 1, -1, 1;$
		$R_3;$	$1; -1, 1, 1;$
		$R_4;$	$1; -1, -1, 1;$
$U; \text{ZU};$	$C_{2a, \sigma_z, I\mathcal{T}};$	$R_1;$	$1; -1, -1, 1;$
		$R_2;$	$1; -1, 1, 1;$
		$R_3;$	$1; 1, -1, 1;$
		$R_4;$	$1; 1, 1, 1;$
$Y; \text{XZ}/\text{XY};$	$C_{2b, \sigma_{da}, I\mathcal{T}};$	$R_1;$	$1; 1, 1, 1;$
		$R_2;$	$1; 1, -1, 1;$
		$R_3;$	$1; -1, 1, 1;$
		$R_4;$	$1; -1, -1, 1;$

SG 141

 $\Gamma_q^v; \{C_{4z}^+ | 0\frac{1}{2}0\}, \{C_{2x} | \frac{1}{2}\frac{1}{2}0\}, \{I | \frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$		
		$R_2; 1; 1, -1, 1, 1;$		
		$R_3; 1; -1, 1, 1, 1;$		
		$R_4; 1; -1, -1, 1, 1;$		
		$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
		$R_6; 1; 1, 1, -1, 1;$		
		$R_7; 1; 1, -1, -1, 1;$		
		$R_8; 1; -1, 1, -1, 1;$		
		$R_9; 1; -1, -1, -1, 1;$		
		$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$C_{2y}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
		$R_2; 1; 1, -1, 1;$		
		$R_3; 1; -1, 1, 1;$		
		$R_4; 1; -1, -1, 1;$		
$X; (00\frac{1}{2});$	$\sigma_z, \sigma_{da}, C_{2a}, \mathcal{T};$	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
		$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_{db}, C_{2a}, \mathcal{T};$	$R_9; 2; \sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
		$R_{11}; 2; -i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
		$R_{12}; 2; -\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
		$R_{14}; 2; -i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^-, E, C_{2y}, I, \mathcal{T};$	$R_{13}; 2; (\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), -i\sigma_0, \sigma_1, -i\sigma_1;$	P-WNL $_{XP};$	
		$R_{14}; 2; (-\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), -i\sigma_0, \sigma_1, -i\sigma_1;$	P-WNL $_{XP};$	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
		$R_2; 1; 1, -1, 1;$		
		$R_3; 1; -1, 1, 1;$		
		$R_4; 1; -1, -1, 1;$		
		$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
$V; ZV;$	$C_{4z}^+, \sigma_x, E, I, \mathcal{T};$	$R_6; 1; -i, 1, 1, 1;$		
		$R_7; 1; -i, -1, 1, 1;$		
		$R_8; 1; i, 1, 1, 1;$		
		$R_9; 1; i, -1, 1, 1;$		
		$R_{10}; 2; \sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	QNL;	0
$W; XP;$	$C_{2z}, \sigma_{db}, I, \mathcal{T};$	$R_5; 2; \sigma_2, -i\sigma_3, -\sigma_0;$	WNL;	$\pi$
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
		$R_2; 1; 1, -1, 1;$		
		$R_3; 1; -1, 1, 1;$		
		$R_4; 1; -1, -1, 1;$		
$F; ZF;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_1; 1; -1, 1, 1;$		
		$R_2; 1; -1, -1, 1;$		
		$R_3; 1; 1, 1, 1;$		
		$R_4; 1; 1, -1, 1;$		

$Q$ ; NP;	$C_{2y,IT}$ ;	$R_2$ ; 1; 1, 1;
		$R_4$ ; 1; -1, 1;
$\Delta$ ; $\Gamma X$ ;	$C_{2a,\sigma_z,IT}$ ;	$R_1$ ; 1; 1, 1, 1;
		$R_2$ ; 1; 1, -1, 1;
		$R_3$ ; 1; -1, 1, 1;
		$R_4$ ; 1; -1, -1, 1;
$U$ ; ZU;	$C_{2a,\sigma_z,IT}$ ;	$R_5$ ; 2; $\sigma_2, \sigma_3, -\sigma_0$ ; WNL; $\pi$
$Y$ ; XZ/XY;	$C_{2b,\sigma_{da},IT}$ ;	$R_5$ ; 2; $\sigma_2, \sigma_3, -\sigma_0$ ; WNL; $\pi$

SG 142

 $\Gamma_q^v; \{C_{4z}^+ | \frac{1}{2}00\}, \{C_{2x} | \frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
		$R_2;$	1; 1, -1, 1, 1;		
		$R_3;$	1; -1, 1, 1, 1;		
		$R_4;$	1; -1, -1, 1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
		$R_6;$	1; 1, 1, -1, 1;		
		$R_7;$	1; 1, -1, -1, 1;		
		$R_8;$	1; -1, 1, -1, 1;		
		$R_9;$	1; -1, -1, -1, 1;		
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$X; (00\frac{1}{2});$	$\sigma_z, C_{2z}, C_{2a}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
		$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
		$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
		$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^-, E, C_{2y}, I\mathcal{T}; \{R_{13}, R_{14}\};$	4; $(\frac{1}{2} - \frac{i}{2})(\Gamma_{0,3} + i\Gamma_{3,0}),$	DP;	0	
			$-i\Gamma_{0,0}, \Gamma_{3,1}, \Gamma_{1,0};$		
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
		$R_6;$	1; $i, 1, 1, 1;$		
		$R_7;$	1; $i, -1, 1, 1;$		
		$R_8;$	1; $-i, 1, 1, 1;$		
		$R_9;$	1; $-i, -1, 1, 1;$		
		$R_{10};$	2; $-\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	QNL;	0
$W; \text{XP};$	$C_{2z}, \sigma_{da}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -\sigma_0;$	WNL;	$\pi$
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$F; \text{ZF};$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; -1, 1, 1;		
		$R_2;$	1; -1, -1, 1;		
		$R_3;$	1; 1, 1, 1;		
		$R_4;$	1; 1, -1, 1;		
$Q; \text{NP};$	$C_{2y}, I\mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Delta; \Gamma X;$	$C_{2a}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$U; \text{ZU};$	$C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -\sigma_0;$	WNL;	$\pi$
$Y; \text{XZ}/\text{XY};$	$C_{2b}, \sigma_{da}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -\sigma_0;$	WNL;	$\pi$

SG 143

 $\Gamma_h; \{C_3^+|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_3^+; \mathcal{T};$	$R_1;$	$1; 1, 1;$
			$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1; \text{C-2 WP}; 2$
$M;$	$(0\frac{1}{2}0);$	$E; \mathcal{T};$	$R_1;$	$1; 1, 1;$
$A;$	$(00\frac{1}{2});$	$C_3^+; \mathcal{T};$	$R_1;$	$1; 1, 1;$
			$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1; \text{C-2 WP}; 2$
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$E; \mathcal{T};$	$R_1;$	$1; 1, 1;$
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+;$	$R_1;$	$1; 1;$
			$R_2;$	$1; (-1)^{2/3};$
			$R_3;$	$1; -\sqrt[3]{-1};$
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+;$	$R_1;$	$1; 1;$
			$R_2;$	$1; (-1)^{2/3};$
			$R_3;$	$1; -\sqrt[3]{-1};$
$\Delta;$	$\Gamma A;$	$C_3^+;$	$R_1;$	$1; 1;$
			$R_2;$	$1; (-1)^{2/3};$
			$R_3;$	$1; -\sqrt[3]{-1};$
$U;$	$ML;$	$E;$	$R_1;$	$1; 1;$
$P;$	$KH;$	$C_3^+;$	$R_1;$	$1; 1;$
			$R_2;$	$1; (-1)^{2/3};$
			$R_3;$	$1; -\sqrt[3]{-1};$
$T;$	$\Gamma K;$	$E;$	$R_1;$	$1; 1;$
$S;$	$AH;$	$E;$	$R_1;$	$1; 1;$
$T';$	$MK;$	$E;$	$R_1;$	$1; 1;$
$S';$	$LH;$	$E;$	$R_1;$	$1; 1;$
$\Sigma;$	$\Gamma M;$	$E;$	$R_1;$	$1; 1;$
$R;$	$AL;$	$E;$	$R_1;$	$1; 1;$



SG 144

 $\Gamma_h$ ;  $\{C_3^+|00\frac{1}{3}\}$ ,  $\mathcal{T}$ ; Non-Centrosymmetric; without SOC

$\Gamma$ ; (000);	$C_3^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
		$\{R_2, R_3\}$ ;	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1$ ; C-2 WP; 2
$M$ ; $(0\frac{1}{2}0)$ ;	$E, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
$A$ ; $(00\frac{1}{2})$ ;	$C_3^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
		$\{R_2, R_3\}$ ;	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1$ ; C-2 WP; 2
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ;	$E, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ;	$C_3^+$ ;	$R_1$ ;	1; 1;
		$R_2$ ;	1; $(-1)^{2/3}$ ;
		$R_3$ ;	1; $-\sqrt[3]{-1}$ ;
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ;	$C_3^-$ ;	$R_1$ ;	1; 1;
		$R_2$ ;	1; $(-1)^{2/3}$ ;
		$R_3$ ;	1; $-\sqrt[3]{-1}$ ;
$\Delta$ ; $\Gamma A$ ;	$C_3^+$ ;	$R_1$ ;	1; 1;
		$R_2$ ;	1; $(-1)^{2/3}$ ;
		$R_3$ ;	1; $-\sqrt[3]{-1}$ ;
$U$ ; ML;	$E$ ;	$R_1$ ;	1; 1;
$P$ ; KH;	$C_3^+$ ;	$R_1$ ;	1; 1;
		$R_2$ ;	1; $(-1)^{2/3}$ ;
		$R_3$ ;	1; $-\sqrt[3]{-1}$ ;
$T$ ; $\Gamma K$ ;	$E$ ;	$R_1$ ;	1; 1;
$S$ ; AH;	$E$ ;	$R_1$ ;	1; 1;
$T'$ ; MK;	$E$ ;	$R_1$ ;	1; 1;
$S'$ ; LH;	$E$ ;	$R_1$ ;	1; 1;
$\Sigma$ ; $\Gamma M$ ;	$E$ ;	$R_1$ ;	1; 1;
$R$ ; AL;	$E$ ;	$R_1$ ;	1; 1;

SG 145

 $\Gamma_h$ ;  $\{C_3^+|00\frac{2}{3}\}$ ,  $\mathcal{T}$ ; Non-Centrosymmetric; without SOC

$\Gamma$ ; (000);	$C_3^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
		$\{R_2, R_3\}$ ;	2; $\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1$ ; C-2 WP; 2
$M$ ; $(0\frac{1}{2}0)$ ;	$E, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
$A$ ; $(00\frac{1}{2})$ ;	$C_3^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
		$\{R_2, R_3\}$ ;	2; $\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1$ ; C-2 WP; 2
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ;	$E, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ;	$C_3^+$ ;	$R_1$ ;	1; 1;
		$R_2$ ;	1; $(-1)^{2/3}$ ;
		$R_3$ ;	1; $-\sqrt[3]{-1}$ ;
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ;	$C_3^+$ ;	$R_1$ ;	1; 1;
		$R_2$ ;	1; $(-1)^{2/3}$ ;
		$R_3$ ;	1; $-\sqrt[3]{-1}$ ;
$\Delta$ ; $\Gamma A$ ;	$C_3^+$ ;	$R_1$ ;	1; 1;
		$R_2$ ;	1; $(-1)^{2/3}$ ;
		$R_3$ ;	1; $-\sqrt[3]{-1}$ ;
$U$ ; ML;	$E$ ;	$R_1$ ;	1; 1;
$P$ ; KH;	$C_3^+$ ;	$R_1$ ;	1; 1;
		$R_2$ ;	1; $(-1)^{2/3}$ ;
		$R_3$ ;	1; $-\sqrt[3]{-1}$ ;
$T$ ; $\Gamma K$ ;	$E$ ;	$R_1$ ;	1; 1;
$S$ ; AH;	$E$ ;	$R_1$ ;	1; 1;
$T'$ ; MK;	$E$ ;	$R_1$ ;	1; 1;
$S'$ ; LH;	$E$ ;	$R_1$ ;	1; 1;
$\Sigma$ ; $\Gamma M$ ;	$E$ ;	$R_1$ ;	1; 1;
$R$ ; AL;	$E$ ;	$R_1$ ;	1; 1;

SG 146

 $\Gamma_{rh}; \{C_3^+|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_3^+; \mathcal{T};$	$R_1;$	$1; 1, 1;$
			$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1; \text{C-2 WP}; 2$
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_3^+; \mathcal{T};$	$R_1;$	$1; 1, 1;$
			$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1; \text{C-2 WP}; 2$
$L;$	$(0\frac{1}{2}0);$	$E; \mathcal{T};$	$R_1;$	$1; 1, 1;$
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$E; \mathcal{T};$	$R_1;$	$1; 1, 1;$
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$E; \mathcal{T};$	$R_1;$	$1; 1, 1;$
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+;$	$R_1;$	$1; 1;$
			$R_2;$	$1; (-1)^{2/3};$
			$R_3;$	$1; -\sqrt[3]{-1};$
$P;$	$ZP;$	$C_3^+;$	$R_1;$	$1; 1;$
			$R_2;$	$1; (-1)^{2/3};$
			$R_3;$	$1; -\sqrt[3]{-1};$
$B;$	$ZB;$	$E;$	$R_1;$	$1; 1;$
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$E;$	$R_1;$	$1; 1;$
$Q;$	$FQ;$	$E;$	$R_1;$	$1; 1;$
$Y;$	$LZ/LY;$	$E;$	$R_1;$	$1; 1;$

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 $\Gamma_h; \{S_6^+|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$S_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNLs;
			$\{R_3, R_5\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNLs;
			$R_4;$	$1; -1, 1;$	
$M;$	$(0\frac{1}{2}0);$	$I, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$R_2;$	$1; -1, 1;$	
$A;$	$(00\frac{1}{2});$	$S_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNLs;
			$\{R_3, R_5\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNLs;
			$R_4;$	$1; -1, 1;$	
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$I, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$R_2;$	$1; -1, 1;$	
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNL <sub>KH</sub> ;
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNL <sub>KH</sub> ;
$\Delta;$	$\Gamma A;$	$C_3^+, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	WNL; $\pi$
$U;$	$ML;$	$E, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
$P;$	$KH;$	$C_3^+, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	WNL; $\pi$
$T;$	$\Gamma K;$	$E, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S;$	$AH;$	$E, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
$T';$	$MK;$	$E, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S';$	$LH;$	$E, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
$\Sigma;$	$\Gamma M;$	$E, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
$R;$	$AL;$	$E, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	

SG 148

 $\Gamma_{rh}; \{S_6^+|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$S_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNLs;
			$\{R_3, R_5\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNLs;
			$R_4;$	$1; -1, 1;$	
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNLs;
			$\{R_3, R_5\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNLs;
			$R_4;$	$1; -1, 1;$	
$L;$	$(0\frac{1}{2}0);$	$I, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$R_2;$	$1; -1, 1;$	
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$I, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$R_2;$	$1; -1, 1;$	
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$I, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$R_2;$	$1; -1, 1;$	
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	WNL; $\pi$
$P;$	$ZP;$	$C_3^+, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
			$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	WNL; $\pi$
$B;$	$ZB;$	$E, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$E, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
$Q;$	$FQ;$	$E, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	
$Y;$	$LZ/LY;$	$E, I\mathcal{T};$	$R_1;$	$1; 1, 1;$	

SG 149

 $\Gamma_h; \{C_3^+|000\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}', \mathcal{T};$	$R_1; 1; 1, 1, 1;$
			$R_2; 1; 1, -1, 1;$
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0; \text{C-2 WP}; 2$
$M;$	$(0\frac{1}{2}0);$	$C_{21}', \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$A;$	$(00\frac{1}{2});$	$C_3^+, C_{21}', \mathcal{T};$	$R_1; 1; 1, 1, 1;$
			$R_2; 1; 1, -1, 1;$
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0; \text{C-2 WP}; 2$
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}', \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, C_{22}'\mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; (-1)^{2/3}, 1;$
			$R_3; 1; -\sqrt[3]{-1}, 1;$
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, C_{22}'\mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; (-1)^{2/3}, 1;$
			$R_3; 1; -\sqrt[3]{-1}, 1;$
$\Delta;$	$\Gamma A;$	$C_3^+, C_{22}'\mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; (-1)^{2/3}, 1;$
			$R_3; 1; -\sqrt[3]{-1}, 1;$
$U;$	$ML;$	$E, C_{21}'\mathcal{T};$	$R_1; 1; 1, 1;$
$P;$	$KH;$	$C_3^+, C_{22}'\mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; (-1)^{2/3}, 1;$
			$R_3; 1; -\sqrt[3]{-1}, 1;$
$T;$	$\Gamma K;$	$E, C_{22}'\mathcal{T};$	$R_1; 1; 1, 1;$
$S;$	$AH;$	$E, C_{22}'\mathcal{T};$	$R_1; 1; 1, 1;$
$T';$	$MK;$	$E, C_{21}'\mathcal{T};$	$R_1; 1; 1, 1;$
$S';$	$LH;$	$E, C_{21}'\mathcal{T};$	$R_1; 1; 1, 1;$
$\Sigma;$	$\Gamma M;$	$C_{21}';$	$R_1; 1; 1;$
			$R_2; 1; -1;$
$R;$	$AL;$	$C_{21}';$	$R_1; 1; 1;$
			$R_2; 1; -1;$

SG 150

 $\Gamma_h; \{C_3^+|000\}, \{C_{21}''|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
			$R_2; 1; 1, -1, 1;$	
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M;$	$(0\frac{1}{2}0);$	$C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$A;$	$(00\frac{1}{2});$	$C_3^+, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
			$R_2; 1; 1, -1, 1;$	
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, C_{21}'';$	$R_1; 1; 1, 1;$	
			$R_2; 1; 1, -1;$	
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	C-1 WP; 1
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, C_{21}'';$	$R_1; 1; 1, 1;$	
			$R_2; 1; 1, -1;$	
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	C-1 WP; 1
$\Delta;$	$\Gamma A;$	$C_3^+, C_{22}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; (-1)^{2/3}, 1;$	
			$R_3; 1; -\sqrt[3]{-1}, 1;$	
$U;$	ML;	$E, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
$P;$	KH;	$C_3^+;$	$R_1; 1; 1;$	
			$R_2; 1; (-1)^{2/3};$	
			$R_3; 1; -\sqrt[3]{-1};$	
$T;$	$\Gamma K;$	$C_{22}'';$	$R_1; 1; 1;$	
			$R_2; 1; -1;$	
$S;$	AH;	$C_{22}'';$	$R_1; 1; 1;$	
			$R_2; 1; -1;$	
$T';$	MK;	$C_{21}'';$	$R_1; 1; 1;$	
			$R_2; 1; -1;$	
$S';$	LH;	$C_{21}'';$	$R_1; 1; 1;$	
			$R_2; 1; -1;$	
$\Sigma;$	$\Gamma M;$	$E, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
$R;$	AL;	$E, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	

SG 151

 $\Gamma_h; \{C_3^+|00\frac{1}{3}\}, \{C'_{21}|00\frac{2}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma;$	$(000);$	$C_3^+, C'_{21}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
			$R_2; 1; 1, -1, 1;$
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0; \text{C-2 WP}; 2$
$M;$	$(0\frac{1}{2}0);$	$C'_{21}, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$A;$	$(00\frac{1}{2});$	$C_3^+, C'_{21}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$
			$R_2; 1; 1, -1, 1;$
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0; \text{C-2 WP}; 2$
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C'_{21}, \mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; -1, 1;$
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, C'_{22}\mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; (-1)^{2/3}, 1;$
			$R_3; 1; -\sqrt[3]{-1}, 1;$
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^-, C'_{22}\mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; (-1)^{2/3}, 1;$
			$R_3; 1; -\sqrt[3]{-1}, 1;$
$\Delta;$	$\Gamma A;$	$C_3^+, C'_{22}\mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; (-1)^{2/3}, 1;$
			$R_3; 1; -\sqrt[3]{-1}, 1;$
$U;$	$\text{ML};$	$E, C'_{21}\mathcal{T};$	$R_1; 1; 1, 1;$
$P;$	$\text{KH};$	$C_3^+, C'_{22}\mathcal{T};$	$R_1; 1; 1, 1;$
			$R_2; 1; (-1)^{2/3}, 1;$
			$R_3; 1; -\sqrt[3]{-1}, 1;$
$T;$	$\Gamma K;$	$E, C'_{22}\mathcal{T};$	$R_1; 1; 1, 1;$
$S;$	$\text{AH};$	$E, C'_{22}\mathcal{T};$	$R_1; 1; 1, 1;$
$T';$	$\text{MK};$	$E, C'_{21}\mathcal{T};$	$R_1; 1; 1, 1;$
$S';$	$\text{LH};$	$E, C'_{21}\mathcal{T};$	$R_1; 1; 1, 1;$
$\Sigma;$	$\Gamma M;$	$C'_{21};$	$R_1; 1; 1;$
			$R_2; 1; -1;$
$R;$	$\text{AL};$	$C'_{21};$	$R_3; 1; 1;$
			$R_6; 1; -1;$



SG 152

 $\Gamma_h; \{C_3^+|00\frac{1}{3}\}, \{C_{21}''|00\frac{2}{3}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
			$R_2; 1; 1, -1, 1;$	
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M;$	$(0\frac{1}{2}0);$	$C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$A;$	$(00\frac{1}{2});$	$C_3^+, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
			$R_2; 1; 1, -1, 1;$	
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, C_{21}'';$	$R_1; 1; 1, 1;$	
			$R_2; 1; 1, -1;$	
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	C-1 WP; 1
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, C_{21}'';$	$R_1; 1; 1, 1;$	
			$R_2; 1; 1, -1;$	
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	C-1 WP; 1
$\Delta;$	$\Gamma A;$	$C_3^+, C_{22}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; (-1)^{2/3}, 1;$	
			$R_3; 1; -\sqrt[3]{-1}, 1;$	
$U;$	ML;	$E, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
$P;$	KH;	$C_3^+;$	$R_1; 1; 1;$	
			$R_2; 1; (-1)^{2/3};$	
			$R_3; 1; -\sqrt[3]{-1};$	
$T;$	$\Gamma K;$	$C_{22}'';$	$R_1; 1; 1;$	
			$R_2; 1; -1;$	
$S;$	AH;	$C_{22}'';$	$R_2; 1; 1;$	
			$R_5; 1; -1;$	
$T';$	MK;	$C_{21}'';$	$R_1; 1; 1;$	
			$R_2; 1; -1;$	
$S';$	LH;	$C_{21}'';$	$R_3; 1; 1;$	
			$R_6; 1; -1;$	
$\Sigma;$	$\Gamma M;$	$E, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
$R;$	AL;	$E, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	

SG 153

 $\Gamma_h; \{C_3^+|00\frac{2}{3}\}, \{C_{21}'|00\frac{1}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; (000); C_3^+, C_{21}', \mathcal{T}; R_1; 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0; \text{C-2 WP}; 2 \\
M; (0\frac{1}{2}0); C_{21}', \mathcal{T}; R_1; 1; 1, 1; \\
& R_2; 1; -1, 1; \\
A; (00\frac{1}{2}); C_3^+, C_{21}', \mathcal{T}; R_1; 1; 1, 1, 1; \\
& R_2; 1; 1, -1, 1; \\
& R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0; \text{C-2 WP}; 2 \\
L; (0\frac{1}{2}\frac{1}{2}); C_{21}', \mathcal{T}; R_1; 1; 1, 1; \\
& R_2; 1; -1, 1; \\
K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_{22}'\mathcal{T}; R_1; 1; 1, 1; \\
& R_2; 1; (-1)^{2/3}, 1; \\
& R_3; 1; -\sqrt[3]{-1}, 1; \\
H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, C_{22}'\mathcal{T}; R_1; 1; 1, 1; \\
& R_2; 1; (-1)^{2/3}, 1; \\
& R_3; 1; -\sqrt[3]{-1}, 1; \\
\Delta; \Gamma A; C_3^+, C_{22}'\mathcal{T}; R_1; 1; 1, 1; \\
& R_2; 1; (-1)^{2/3}, 1; \\
& R_3; 1; -\sqrt[3]{-1}, 1; \\
U; ML; E, C_{21}'\mathcal{T}; R_1; 1; 1, 1; \\
P; KH; C_3^+, C_{22}'\mathcal{T}; R_1; 1; 1, 1; \\
& R_2; 1; (-1)^{2/3}, 1; \\
& R_3; 1; -\sqrt[3]{-1}, 1; \\
T; \Gamma K; E, C_{22}'\mathcal{T}; R_1; 1; 1, 1; \\
S; AH; E, C_{22}'\mathcal{T}; R_1; 1; 1, 1; \\
T'; MK; E, C_{21}'\mathcal{T}; R_1; 1; 1, 1; \\
S'; LH; E, C_{21}'\mathcal{T}; R_1; 1; 1, 1; \\
\Sigma; \Gamma M; C_{21}'; R_1; 1; 1; \\
& R_2; 1; -1; \\
R; AL; C_{21}'; R_2; 1; 1; \\
& R_5; 1; -1;
\end{aligned}$$

SG 154

 $\Gamma_h; \{C_3^+|00\frac{2}{3}\}, \{C_{21}''|00\frac{1}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma$ ; $(000)$ ; $C_3^+, C_{21}'', \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;
	$R_3$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0$ ; C-2 WP; 2
$M$ ; $(0\frac{1}{2}0)$ ; $C_{21}'', \mathcal{T}$ ; $R_1$ ; 1; 1, 1;	
	$R_2$ ; 1; -1, 1;
$A$ ; $(00\frac{1}{2})$ ; $C_3^+, C_{21}'', \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;
	$R_3$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0$ ; C-2 WP; 2
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_{21}'', \mathcal{T}$ ; $R_1$ ; 1; 1, 1;	
	$R_2$ ; 1; -1, 1;
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+, C_{21}''$ ; $R_1$ ; 1; 1, 1;	
	$R_2$ ; 1; 1, -1;
	$R_3$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3$ ; C-1 WP; 1
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^+, C_{21}''$ ; $R_1$ ; 1; 1, 1;	
	$R_2$ ; 1; 1, -1;
	$R_3$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3$ ; C-1 WP; 1
$\Delta$ ; $\Gamma A$ ; $C_3^+, C_{22}'', \mathcal{T}$ ; $R_1$ ; 1; 1, 1;	
	$R_2$ ; 1; $(-1)^{2/3}, 1$ ;
	$R_3$ ; 1; $-\sqrt[3]{-1}, 1$ ;
$U$ ; ML; $E, C_{21}'', \mathcal{T}$ ; $R_1$ ; 1; 1, 1;	
$P$ ; KH; $C_3^+$ ; $R_1$ ; 1; 1;	
	$R_2$ ; 1; $(-1)^{2/3}$ ;
	$R_3$ ; 1; $-\sqrt[3]{-1}$ ;
$T$ ; $\Gamma K$ ; $C_{22}''$ ; $R_1$ ; 1; 1;	
	$R_2$ ; 1; -1;
$S$ ; AH; $C_{22}''$ ; $R_3$ ; 1; 1;	
	$R_6$ ; 1; -1;
$T'$ ; MK; $C_{21}''$ ; $R_1$ ; 1; 1;	
	$R_2$ ; 1; -1;
$S'$ ; LH; $C_{21}''$ ; $R_2$ ; 1; 1;	
	$R_5$ ; 1; -1;
$\Sigma$ ; $\Gamma M$ ; $E, C_{21}'', \mathcal{T}$ ; $R_1$ ; 1; 1, 1;	
$R$ ; AL; $E, C_{21}'', \mathcal{T}$ ; $R_1$ ; 1; 1, 1;	

SG 155

 $\Gamma_{rh}; \{C_3^+|000\}, \{C'_{21}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_3^+, C'_{21}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$ $R_2; 1; 1, -1, 1;$ $R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0; \text{C-2 WP}; 2$
$Z;$	$(\frac{1}{2}\frac{1}{2}\bar{\frac{1}{2}});$	$C_3^+, C'_{21}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$ $R_2; 1; 1, -1, 1;$ $R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0; \text{C-2 WP}; 2$
$L;$	$(0\frac{1}{2}0);$	$C'_{22}, \mathcal{T};$	$R_1; 1; 1, 1;$ $R_2; 1; -1, 1;$
$(a)F;$	$(0\frac{1}{2}\bar{\frac{1}{2}});$	$C'_{21}, \mathcal{T};$	$R_1; 1; 1, 1;$ $R_2; 1; -1, 1;$
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$C'_{23}, \mathcal{T};$	$R_1; 1; 1, 1;$ $R_2; 1; -1, 1;$
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, C'_{22}, \mathcal{T};$	$R_1; 1; 1, 1;$ $R_2; 1; (-1)^{2/3}, 1;$ $R_3; 1; -\sqrt[3]{-1}, 1;$
$P;$	$ZP;$	$C_3^+, C'_{22}, \mathcal{T};$	$R_1; 1; 1, 1;$ $R_2; 1; (-1)^{2/3}, 1;$ $R_3; 1; -\sqrt[3]{-1}, 1;$
$B;$	$ZB;$	$C'_{21};$	$R_1; 1; 1;$ $R_2; 1; -1;$
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$C'_{21};$	$R_1; 1; 1;$ $R_2; 1; -1;$
$Q;$	$FQ;$	$C'_{23};$	$R_1; 1; 1;$ $R_2; 1; -1;$
$Y;$	$LZ/LY;$	$C'_{22};$	$R_1; 1; 1;$ $R_2; 1; -1;$

SG 156

 $\Gamma_h$ ;  $\{C_3^+|000\}, \{\sigma_{v1}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$\Gamma$ ; $(000)$ ; $C_3^+, \sigma_{v1}, \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;
	$R_3$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0$ ; P-WNLs;
$M$ ; $(0\frac{1}{2}0)$ ; $\sigma_{v1}, \mathcal{T}$ ; $R_1$ ; 1; 1, 1;	
	$R_2$ ; 1; -1, 1;
$A$ ; $(00\frac{1}{2})$ ; $C_3^+, \sigma_{v1}, \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;
	$R_3$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0$ ; P-WNLs;
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $\sigma_{v1}, \mathcal{T}$ ; $R_1$ ; 1; 1, 1;	
	$R_2$ ; 1; -1, 1;
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+, \mathcal{T}\sigma_{v2}$ ; $R_1$ ; 1; 1, 1;	
	$R_2$ ; 1; $(-1)^{2/3}, 1$ ;
	$R_3$ ; 1; $-\sqrt[3]{-1}, 1$ ;
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^+, \mathcal{T}\sigma_{v2}$ ; $R_1$ ; 1; 1, 1;	
	$R_2$ ; 1; $(-1)^{2/3}, 1$ ;
	$R_3$ ; 1; $-\sqrt[3]{-1}, 1$ ;
$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}$ ; $R_1$ ; 1; 1, 1;	
	$R_2$ ; 1; 1, -1;
	$R_3$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3$ ; WNL; $\pi$
$U$ ; ML; $\sigma_{v1}$ ; $R_1$ ; 1; 1;	
	$R_2$ ; 1; -1;
$P$ ; KH; $C_3^+$ ; $R_1$ ; 1; 1;	
	$R_2$ ; 1; $(-1)^{2/3}$ ;
	$R_3$ ; 1; $-\sqrt[3]{-1}$ ;
$T$ ; $\Gamma K$ ; $E, \mathcal{T}\sigma_{v2}$ ; $R_1$ ; 1; 1, 1;	
$S$ ; AH; $E, \mathcal{T}\sigma_{v2}$ ; $R_1$ ; 1; 1, 1;	
$T'$ ; MK; $E, \mathcal{T}\sigma_{v1}$ ; $R_1$ ; 1; 1, 1;	
$S'$ ; LH; $E, \mathcal{T}\sigma_{v1}$ ; $R_1$ ; 1; 1, 1;	
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}$ ; $R_1$ ; 1; 1;	
	$R_2$ ; 1; -1;
$R$ ; AL; $\sigma_{v1}$ ; $R_1$ ; 1; 1;	
	$R_2$ ; 1; -1;

SG 157

 $\Gamma_h; \{C_3^+|000\}, \{\sigma_{d1}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_3^+, \sigma_{d1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNLs;	
$M;$	$(0\frac{1}{2}0);$	$\sigma_{d1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; -1, 1, 1;$		
$A;$	$(00\frac{1}{2});$	$C_3^+, \sigma_{d1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNLs;	
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_{d1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; -1, 1, 1;$		
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, \sigma_{d1};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	P-WNL <sub>KH</sub> ;	
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, \sigma_{d1};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	P-WNL <sub>KH</sub> ;	
$\Delta;$	$\Gamma A;$	$C_3^+, \sigma_{d1};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$U;$	ML;	$\sigma_{d1};$	$R_1; 1; 1;$		
			$R_2; 1; -1;$		
$P;$	KH;	$C_3^+, \sigma_{d1};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$T;$	$\Gamma K;$	$\sigma_{d2};$	$R_1; 1; 1;$		
			$R_2; 1; -1;$		
$S;$	AH;	$\sigma_{d2};$	$R_1; 1; 1;$		
			$R_2; 1; -1;$		
$T';$	MK;	$\sigma_{d1};$	$R_1; 1; 1;$		
			$R_2; 1; -1;$		
$S';$	LH;	$\sigma_{d1};$	$R_1; 1; 1;$		
			$R_2; 1; -1;$		
$\Sigma;$	$\Gamma M;$	$E, \mathcal{T}\sigma_{d1};$	$R_1; 1; 1, 1, 1;$		
$R;$	AL;	$E, \mathcal{T}\sigma_{d1};$	$R_1; 1; 1, 1, 1;$		

SG 158

 $\Gamma_h; \{C_3^+|000\}, \{\sigma_{v1}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$ (000);	$C_3^+, \sigma_{v1}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNLs;	
$M;$ ( $0\frac{1}{2}0$ );	$\sigma_{v1}, \mathcal{T};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$A;$ ( $00\frac{1}{2}$ );	$C_3^+, \sigma_{v1}, \mathcal{T};$	$\{R_3, R_4\};$	2; $-\sigma_0, i\sigma_3, \sigma_1;$	P-WNLs;	
		$\{R_6, R_6\};$	4; $\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2}}{2}, i\Gamma_{0,3}, -\Gamma_{2,2};$	DP;	0
$L;$ ( $0\frac{1}{2}\frac{1}{2}$ );	$\sigma_{v1}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	P-WNL;	
$K;$ ( $\frac{1}{3}\frac{2}{3}0$ );	$C_3^+, \mathcal{T}\sigma_{v2};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; $(-1)^{2/3}, 1;$		
		$R_3;$	1; $(-1)^{4/3}, 1;$		
$H;$ ( $\frac{1}{3}\frac{2}{3}\frac{1}{2}$ );	$C_3^+, \mathcal{T}\sigma_{v2};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	P-WNLs;	
		$\{R_2, R_2\};$	2; $(-1)^{2/3}\sigma_0, -i\sigma_2;$	P-WNLs;	
		$\{R_3, R_3\};$	2; $(-1)^{4/3}\sigma_0, -i\sigma_2;$	P-WNLs;	
$\Delta;$ $\Gamma A;$	$C_3^+, \sigma_{v1};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$U;$ ML;	$\sigma_{v1};$	$R_1;$	1; 1;		
		$R_2;$	1; -1;		
$P;$ KH;	$C_3^+;$	$R_1;$	1; 1;		
		$R_2;$	1; $(-1)^{2/3};$		
		$R_3;$	1; $-\sqrt[3]{-1};$		
$T;$ $\Gamma K;$	$E, \mathcal{T}\sigma_{v2};$	$R_1;$	1; 1, 1;		
$S;$ AH;	$E, \mathcal{T}\sigma_{v2};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$T';$ MK;	$E, \mathcal{T}\sigma_{v1};$	$R_1;$	1; 1, 1;		
$S';$ LH;	$E, \mathcal{T}\sigma_{v1};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$\Sigma;$ $\Gamma M;$	$\sigma_{v1};$	$R_1;$	1; 1;		
		$R_2;$	1; -1;		
$R;$ AL;	$\sigma_{v1};$	$R_1;$	1; $-i;$		
		$R_2;$	1; $i;$		

SG 159

 $\Gamma_h; \{C_3^+|000\}, \{\sigma_{d1}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$ (000);	$C_3^+, \sigma_{d1}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma A}$ ;	
$M;$ (0 $\frac{1}{2}$ 0);	$\sigma_{d1}, \mathcal{T};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$A;$ (00 $\frac{1}{2}$ );	$C_3^+, \sigma_{d1}, \mathcal{T};$	$\{R_3, R_4\};$	2; $-\sigma_0, i\sigma_3, \sigma_1;$	P-WNLs;	
		$\{R_6, R_6\};$	4; $\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2}}{2}, i\Gamma_{0,3}, -\Gamma_{2,2};$	DP;	0
$L;$ (0 $\frac{1}{2}$ $\frac{1}{2}$ );	$\sigma_{d1}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	P-WNLs;	
$K;$ ( $\frac{1}{3}$ $\frac{2}{3}$ 0);	$C_3^+, \sigma_{d1};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	P-WNL $_{KH}$ ;	
$H;$ ( $\frac{1}{3}$ $\frac{2}{3}$ $\frac{1}{2}$ );	$C_3^+, \sigma_{d1};$	$R_3;$	1; -1, $i$ ;		
		$R_4;$	1; -1, $-i$ ;		
		$R_6;$	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	P-WNL $_{KH}$ ;	
		$R_1;$	1; 1, 1;		
$\Delta;$ $\Gamma A;$	$C_3^+, \sigma_{d1};$	$R_2;$	1; 1, -1;		
		$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
		$R_1;$	1; 1;		
$U;$ ML;	$\sigma_{d1};$	$R_2;$	1; -1;		
		$R_1;$	1; 1, 1;		
$P;$ KH;	$C_3^+, \sigma_{d1};$	$R_2;$	1; 1, -1;		
		$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
		$R_1;$	1; 1;		
$T;$ $\Gamma K;$	$\sigma_{d2};$	$R_2;$	1; -1;		
		$R_1;$	1; 1;		
$S;$ AH;	$\sigma_{d2};$	$R_2;$	1; $i$ ;		
		$R_1;$	1; 1;		
$T';$ MK;	$\sigma_{d1};$	$R_2;$	1; -1;		
		$R_1;$	1; $-i$ ;		
$S';$ LH;	$\sigma_{d1};$	$R_2;$	1; $i$ ;		
		$R_1;$	1; 1, 1;		
$\Sigma;$ $\Gamma M;$	$E, \mathcal{T}\sigma_{d1};$	$R_1;$	1; 1, 1;		
$R;$ AL;	$E, \mathcal{T}\sigma_{d1};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL;	$\pi$



SG 160

 $\Gamma_{rh}; \{C_3^+|000\}, \{\sigma_{d1}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$C_3^+, \sigma_{d1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma Z};$	
$Z;$	$(\frac{1}{2}\frac{1}{2}\bar{1});$	$C_3^+, \sigma_{d1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma Z};$	
$L;$	$(0\frac{1}{2}0);$	$\sigma_{d2}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; -1, 1, 1;$		
$(a)F;$	$(0\frac{1}{2}\bar{1});$	$\sigma_{d1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; -1, 1, 1;$		
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$\sigma_{d3}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; -1, 1, 1;$		
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, \sigma_{d1};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$P;$	ZP;	$C_3^+, \sigma_{d1};$	$R_1; 1; 1, 1, 1;$		
			$R_2; 1; 1, -1, 1;$		
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$B;$	ZB;	$E, \mathcal{T}\sigma_{d1};$	$R_1; 1; 1, 1, 1;$		
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$E, \mathcal{T}\sigma_{d1};$	$R_1; 1; 1, 1, 1;$		
$Q;$	FQ;	$E, \mathcal{T}\sigma_{d3};$	$R_1; 1; 1, 1, 1;$		
$Y;$	LZ/LY;	$E, \mathcal{T}\sigma_{d2};$	$R_1; 1; 1, 1, 1;$		

SG 161

 $\Gamma_{rh}; \{C_3^+|000\}, \{\sigma_{d1}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$	(000);	$C_3^+, \sigma_{d1}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
			$R_2;$	1; 1, -1, 1;		
			$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma Z};$	
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_3^+, \sigma_{d1}, \mathcal{T};$	$\{R_3, R_4\};$	2; $-\sigma_0, i\sigma_3, \sigma_1;$	P-WNLs;	
			$\{R_6, R_6\};$	4; $\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2}}{2}, i\Gamma_{0,3}, -\Gamma_{2,2};$	DP;	0
$L;$	$(0\frac{1}{2}0);$	$\sigma_{d2}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	P-WNLs;	
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_{d1}, \mathcal{T};$	$R_1;$	1; 1, 1;		
			$R_2;$	1; -1, 1;		
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$\sigma_{d3}, \mathcal{T};$	$R_1;$	1; 1, 1;		
			$R_2;$	1; -1, 1;		
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, \sigma_{d1};$	$R_1;$	1; 1, 1;		
			$R_2;$	1; 1, -1;		
			$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$P;$	ZP;	$C_3^+, \sigma_{d1};$	$R_1;$	1; 1, 1;		
			$R_2;$	1; 1, -1;		
			$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$B;$	ZB;	$E, \mathcal{T}\sigma_{d1};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$E, \mathcal{T}\sigma_{d1};$	$R_1;$	1; 1, 1;		
$Q;$	FQ;	$E, \mathcal{T}\sigma_{d3};$	$R_1;$	1; 1, 1;		
$Y;$	LZ/LY;	$E, \mathcal{T}\sigma_{d2};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL;	$\pi$

$\Gamma_h; \{S_6^+|000\}, \{C_{21}'|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma;$ (000); $S_6^+, C_{21}', \mathcal{T};$	$R_1;$ 1; 1, 1, 1;
	$R_2;$ 1; 1, -1, 1;
	$R_3;$ 1; -1, 1, 1;
	$R_4;$ 1; -1, -1, 1;
	$R_5;$ 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$ P-WNL $_{\Gamma A};$
	$R_6;$ 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$ P-WNL $_{\Gamma A};$
$M;$ $(0\frac{1}{2}0);$ $C_{21}', I, \mathcal{T};$	$R_1;$ 1; 1, 1, 1;
	$R_2;$ 1; 1, -1, 1;
	$R_3;$ 1; -1, 1, 1;
	$R_4;$ 1; -1, -1, 1;
$A;$ $(00\frac{1}{2});$ $S_6^+, C_{21}', \mathcal{T};$	$R_1;$ 1; 1, 1, 1;
	$R_2;$ 1; 1, -1, 1;
	$R_3;$ 1; -1, 1, 1;
	$R_4;$ 1; -1, -1, 1;
	$R_5;$ 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$ P-WNL $_{\Gamma A};$
	$R_6;$ 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$ P-WNL $_{\Gamma A};$
$L;$ $(0\frac{1}{2}\frac{1}{2});$ $C_{21}', I, \mathcal{T};$	$R_1;$ 1; 1, 1, 1;
	$R_2;$ 1; 1, -1, 1;
	$R_3;$ 1; -1, 1, 1;
	$R_4;$ 1; -1, -1, 1;
$K;$ $(\frac{1}{3}\frac{2}{3}0);$ $C_3^+, \sigma_{d1}, I\mathcal{T};$	$R_1;$ 1; 1, 1, 1;
	$R_2;$ 1; 1, -1, 1;
	$R_3;$ 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$ P-WNL $_{KH};$
$H;$ $(\frac{1}{3}\frac{2}{3}\frac{1}{2});$ $C_3^+, \sigma_{d1}, I\mathcal{T};$	$R_1;$ 1; 1, 1, 1;
	$R_2;$ 1; 1, -1, 1;
	$R_3;$ 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$ P-WNL $_{KH};$
$\Delta;$ $\Gamma A;$ $C_3^+, \sigma_{d1}, I\mathcal{T};$	$R_1;$ 1; 1, 1, 1;
	$R_2;$ 1; 1, -1, 1;
	$R_3;$ 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$ WNL; $\pi$
$U;$ ML; $\sigma_{d1}, I\mathcal{T};$	$R_1;$ 1; 1, 1;
	$R_2;$ 1; -1, 1;
$P;$ KH; $C_3^+, \sigma_{d1}, I\mathcal{T};$	$R_1;$ 1; 1, 1, 1;
	$R_2;$ 1; 1, -1, 1;
	$R_3;$ 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$ WNL; $\pi$
$T;$ $\Gamma K;$ $\sigma_{d2}, I\mathcal{T};$	$R_1;$ 1; 1, 1;
	$R_2;$ 1; -1, 1;
$S;$ AH; $\sigma_{d2}, I\mathcal{T};$	$R_1;$ 1; 1, 1;
	$R_2;$ 1; -1, 1;
$T';$ MK; $\sigma_{d1}, I\mathcal{T};$	$R_1;$ 1; 1, 1;
	$R_2;$ 1; -1, 1;
$S';$ LH; $\sigma_{d1}, I\mathcal{T};$	$R_1;$ 1; 1, 1;
	$R_2;$ 1; -1, 1;
$\Sigma;$ $\Gamma M;$ $C_{21}', I\mathcal{T};$	$R_1;$ 1; 1, 1;
	$R_2;$ 1; -1, 1;
$R;$ AL; $C_{21}', I\mathcal{T};$	$R_1;$ 1; 1, 1;
	$R_2;$ 1; -1, 1;

SG 163

 $\Gamma_h; \{S_6^+|000\}, \{C'_{21}|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_6^+, C'_{21}, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$1; -1, 1, 1;$		
	$R_4;$	$1; -1, -1, 1;$		
	$R_5;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma A};$	
	$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0); C'_{21}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$1; -1, 1, 1;$		
	$R_4;$	$1; -1, -1, 1;$		
$A; (00\frac{1}{2}); \sigma_{d1}, C_3^+, I, \mathcal{T}; \{R_7, R_8\};$	$4; -i\Gamma_{3,1}, \frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,3}, \Gamma_{1,0};$	DP;		0
	$R_9;$	$2; i\sigma_1, \sigma_0, \sigma_3, -i\sigma_3;$	P-WNLs;	
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{d1}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, \sigma_{d1}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, \sigma_{d1}, I, \mathcal{T};$	$R_3;$	$1; -1, i, 1;$		
	$R_4;$	$1; -1, -i, 1;$		
	$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -\sigma_0;$	P-WNL $_{KH};$	
$\Delta; \Gamma A; C_3^+, \sigma_{d1}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	WNL;	$\pi$
$U; ML; \sigma_{d1}, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$P; KH; C_3^+, \sigma_{d1}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	WNL;	$\pi$
$T; \Gamma K; \sigma_{d2}, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$S; AH; \sigma_{d2}, I, \mathcal{T};$	$R_1;$	$1; -i, 1;$		
	$R_2;$	$1; i, 1;$		
$T'; MK; \sigma_{d1}, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$S'; LH; \sigma_{d1}, I, \mathcal{T};$	$R_1;$	$1; -i, 1;$		
	$R_2;$	$1; i, 1;$		
$\Sigma; \Gamma M; C'_{21}, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$R; AL; C'_{21}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$

$\Gamma_h; \{S_6^+|000\}, \{C_{21}''|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_6^+, C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma A};$	
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0); C_{21}'', I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$A; (00\frac{1}{2}); S_6^+, C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma A};$	
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma A};$	
$L; (0\frac{1}{2}\frac{1}{2}); C_{21}'', I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_{21}'', I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, C_{21}'', I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{KH};$	
$\Delta; \Gamma A; C_3^+, \sigma_{v1}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	WNL;	$\pi$
$U; ML; \sigma_{v1}, I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$P; KH; C_3^+, I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	WNL;	$\pi$
$T; \Gamma K; C_{22}'', I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; AH; C_{22}'', I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$T'; MK; C_{21}'', I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S'; LH; C_{21}'', I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Sigma; \Gamma M; \sigma_{v1}, I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$R; AL; \sigma_{v1}, I, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		

$\Gamma_h; \{S_6^+|000\}, \{C_{21}''|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_6^+, C_{21}'', \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$1; -1, 1, 1;$		
	$R_4;$	$1; -1, -1, 1;$		
	$R_5;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma A};$	
	$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0); C_{21}'', I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$1; -1, 1, 1;$		
	$R_4;$	$1; -1, -1, 1;$		
$A; (00\frac{1}{2}); \sigma_{v1}, C_3^+, I, \mathcal{T}; \{R_7, R_8\};$	$4; -i\Gamma_{3,1}, \frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,3}, \Gamma_{1,0};$	DP;		0
	$R_9;$	$2; i\sigma_1, \sigma_0, \sigma_3, -i\sigma_3;$	P-WNLs;	
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{v1}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_{21}'', I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, C_{21}'', I, \mathcal{T}; \{R_3, R_4\};$	$2; -\sigma_0, \sigma_3, \sigma_1;$	P-WNLs;		
	$\{R_6, R_6\}; 4; \frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2}}{2}, \Gamma_{0,3}, -\Gamma_{2,2};$	DP;		0
$\Delta; \Gamma A; C_3^+, \sigma_{v1}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	WNL;	$\pi$
$U; ML; \sigma_{v1}, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$P; KH; C_3^+, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$\{R_2, R_3\}; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	WNL;		$\pi$
$T; \Gamma K; C_{22}'', I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$S; AH; C_{22}'', I, \mathcal{T};$	$\{R_2, R_4\}; 2; \sigma_3, \sigma_1;$	WNL;		$\pi$
$T'; MK; C_{21}'', I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$S'; LH; C_{21}'', I, \mathcal{T};$	$\{R_2, R_4\}; 2; \sigma_3, \sigma_1;$	WNL;		$\pi$
$\Sigma; \Gamma M; \sigma_{v1}, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$R; AL; \sigma_{v1}, I, \mathcal{T};$	$R_1;$	$1; -i, 1;$		
	$R_2;$	$1; i, 1;$		

$\Gamma_{rh}; \{S_6^+|000\}, \{C_{21}'|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$S_6^+, C_{21}', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
			$R_2; 1; 1, -1, 1;$	
			$R_3; 1; -1, 1, 1;$	
			$R_4; 1; -1, -1, 1;$	
			$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma Z};$
			$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma Z};$
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_6^+, C_{21}', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
			$R_2; 1; 1, -1, 1;$	
			$R_3; 1; -1, 1, 1;$	
			$R_4; 1; -1, -1, 1;$	
			$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma Z};$
			$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma Z};$
$L;$	$(0\frac{1}{2}0);$	$C_{22}', I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
			$R_2; 1; 1, -1, 1;$	
			$R_3; 1; -1, 1, 1;$	
			$R_4; 1; -1, -1, 1;$	
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}', I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
			$R_2; 1; 1, -1, 1;$	
			$R_3; 1; -1, 1, 1;$	
			$R_4; 1; -1, -1, 1;$	
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{23}', I, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
			$R_2; 1; 1, -1, 1;$	
			$R_3; 1; -1, 1, 1;$	
			$R_4; 1; -1, -1, 1;$	
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, \sigma_{d1}, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
			$R_2; 1; 1, -1, 1;$	
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	WNL; $\pi$
$P;$	$ZP;$	$C_3^+, \sigma_{d1}, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
			$R_2; 1; 1, -1, 1;$	
			$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	WNL; $\pi$
$B;$	$ZB;$	$C_{21}', I\mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$C_{21}', I\mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$Q;$	$FQ;$	$C_{23}', I\mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	
$Y;$	$LZ/LY;$	$C_{22}', I\mathcal{T};$	$R_1; 1; 1, 1;$	
			$R_2; 1; -1, 1;$	

SG 167

 $\Gamma_{rh}; \{S_6^+|000\}, \{C'_{21}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma;$	$(000);$	$S_6^+, C'_{21}, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
			$R_2;$	$1; 1, -1, 1;$		
			$R_3;$	$1; -1, 1, 1;$		
			$R_4;$	$1; -1, -1, 1;$		
			$R_5;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma A};$	
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma A};$	
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_{d1}, C_3^+, I, \mathcal{T};$	$\{R_7, R_8\};$	$4; -i\Gamma_{3,1}, \frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,3}, \Gamma_{1,0};$	DP;	0
			$R_9;$	$2; i\sigma_1, \sigma_0, \sigma_3, -i\sigma_3;$	P-WNLs;	
$L;$	$(0\frac{1}{2}0);$	$\sigma_{d2}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$C'_{21}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
			$R_2;$	$1; 1, -1, 1;$		
			$R_3;$	$1; -1, 1, 1;$		
			$R_4;$	$1; -1, -1, 1;$		
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$C'_{23}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
			$R_2;$	$1; 1, -1, 1;$		
			$R_3;$	$1; -1, 1, 1;$		
			$R_4;$	$1; -1, -1, 1;$		
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, \sigma_{d1}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
			$R_2;$	$1; 1, -1, 1;$		
			$R_3;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	WNL;	$\pi$
$P;$	$ZP;$	$C_3^+, \sigma_{d1}, I, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
			$R_2;$	$1; 1, -1, 1;$		
			$R_3;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	WNL;	$\pi$
$B;$	$ZB;$	$C'_{21}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; -\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$C'_{21}, I, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
			$R_2;$	$1; -1, 1;$		
$Q;$	$FQ;$	$C'_{23}, I, \mathcal{T};$	$R_1;$	$1; -1, 1;$		
			$R_2;$	$1; 1, 1;$		
$Y;$	$LZ/LY;$	$C'_{22}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$



$\Gamma_h; \{C_6^+|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$

$\Gamma; (000); C_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_6\}; 2;$	$\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
	$\{R_3, R_5\}; 2;$	$\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
	$R_4;$	$1; -1, 1;$	
$M; (0\frac{1}{2}0); C_2, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$R_2;$	$1; -1, 1;$	
$A; (00\frac{1}{2}); C_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_6\}; 2;$	$\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
	$\{R_3, R_5\}; 2;$	$\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
	$R_4;$	$1; -1, 1;$	
$L; (0\frac{1}{2}\frac{1}{2}); C_2, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$R_2;$	$1; -1, 1;$	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_6^+ \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_3\}; 2;$	$\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- + \frac{(i\sqrt{3}-1)\sigma_+}{2};$	C-1 WP; 1
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, C_6^+ \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_3\}; 2;$	$\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- + \frac{(i\sqrt{3}-1)\sigma_+}{2};$	C-1 WP; 1
$\Delta; \Gamma A; C_6^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; \sqrt[3]{-1};$	
	$R_3;$	$1; (-1)^{2/3};$	
	$R_4;$	$1; -1;$	
	$R_5;$	$1; -\sqrt[3]{-1};$	
	$R_6;$	$1; -(-1)^{2/3};$	
$U; ML; C_2;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	
$P; KH; C_3^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; (-1)^{2/3};$	
	$R_3;$	$1; -\sqrt[3]{-1};$	
$T; \Gamma K; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S; AH; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$T'; MK; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S'; LH; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$\Sigma; \Gamma M; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$R; AL; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	

SG 169

 $\Gamma_h; \{C_6^+ | 00 \frac{1}{6}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
	$\{R_3, R_5\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
$M; (0 \frac{1}{2} 0); C_2, \mathcal{T};$	$R_4;$	$1; -1, 1;$	
	$R_1;$	$1; 1, 1;$	
$A; (00 \frac{1}{2}); C_6^+, \mathcal{T};$	$R_2;$	$1; -1, 1;$	
	$\{R_2, R_{12}\};$	$2; \frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1;$	P-NS <sub>ALH</sub> ;
	$\{R_4, R_{10}\};$	$2; i\sigma_3, \sigma_1;$	P-NS <sub>ALH</sub> ;
$L; (0 \frac{1}{2} \frac{1}{2}); C_2, \mathcal{T};$	$\{R_6, R_8\};$	$2; \frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1;$	P-NS <sub>ALH</sub> ;
	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	P-NS <sub>ALH</sub> ;
$K; (\frac{1}{3} \frac{2}{3} 0); C_3^+, C_6^+ \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- + \frac{i\sqrt{3}-1}{2}\sigma_+;$	C-1 WP; 1
$H; (\frac{1}{3} \frac{2}{3} \frac{1}{2}); C_3^-, C_6^+ \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
	$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- + \frac{1+i\sqrt{3}}{2}\sigma_+;$	P-NS <sub>ALH</sub> ;
$\Delta; \Gamma A; C_6^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; \sqrt[3]{-1};$	
	$R_3;$	$1; (-1)^{2/3};$	
	$R_4;$	$1; -1;$	
	$R_5;$	$1; -\sqrt[3]{-1};$	
	$R_6;$	$1; -(-1)^{2/3};$	
$U; ML; C_2;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	
$P; KH; C_3^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; (-1)^{2/3};$	
	$R_3;$	$1; -\sqrt[3]{-1};$	
$T; \Gamma K; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S; AH; E, C_2 \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$T'; MK; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S'; LH; E, C_2 \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$\Sigma; \Gamma M; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$R; AL; E, C_2 \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;

SG 170

 $\Gamma_h; \{C_6^+ | 00 \frac{5}{6}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
	$\{R_3, R_5\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
$M; (0\frac{1}{2}0); C_2, \mathcal{T};$	$R_4;$	$1; -1, 1;$	
	$R_1;$	$1; 1, 1;$	
$A; (00\frac{1}{2}); C_6^+, \mathcal{T};$	$R_2;$	$1; -1, 1;$	
	$\{R_2, R_{12}\};$	$2; \frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1;$	P-NS <sub>ALH</sub> ;
	$\{R_4, R_{10}\};$	$2; i\sigma_3, \sigma_1;$	P-NS <sub>ALH</sub> ;
$L; (0\frac{1}{2}\frac{1}{2}); C_2, \mathcal{T};$	$\{R_6, R_8\};$	$2; \frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1;$	P-NS <sub>ALH</sub> ;
	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	P-NS <sub>ALH</sub> ;
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_6^+ \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- + \frac{i\sqrt{3}-1}{2}\sigma_+;$	C-1 WP; 1
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^-, C_6^+ \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
	$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- + \frac{1+i\sqrt{3}}{2}\sigma_+;$	P-NS <sub>ALH</sub> ;
$\Delta; \Gamma A; C_6^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; \sqrt[3]{-1};$	
	$R_3;$	$1; (-1)^{2/3};$	
	$R_4;$	$1; -1;$	
	$R_5;$	$1; -\sqrt[3]{-1};$	
	$R_6;$	$1; -(-1)^{2/3};$	
$U; ML; C_2;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	
$P; KH; C_3^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; (-1)^{2/3};$	
	$R_3;$	$1; -\sqrt[3]{-1};$	
$T; \Gamma K; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S; AH; E, C_2 \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$T'; MK; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S'; LH; E, C_2 \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$\Sigma; \Gamma M; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$R; AL; E, C_2 \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;

SG 171

 $\Gamma_h; \{C_6^+ | 00\frac{1}{3}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_6\}; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$		C-2 WP; 2
	$\{R_3, R_5\}; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$		C-2 WP; 2
$M; (0\frac{1}{2}0); C_2, \mathcal{T};$	$R_4;$	$1; -1, 1;$	
	$R_1;$	$1; 1, 1;$	
	$R_2;$	$1; -1, 1;$	
$A; (00\frac{1}{2}); C_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_6\}; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$		C-2 WP; 2
	$\{R_3, R_5\}; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$		C-2 WP; 2
$L; (0\frac{1}{2}\frac{1}{2}); C_2, \mathcal{T};$	$R_4;$	$1; -1, 1;$	
	$R_1;$	$1; 1, 1;$	
	$R_2;$	$1; -1, 1;$	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_6^+ \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_3\}; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- + \frac{(i\sqrt{3}-1)\sigma_+}{2};$		C-1 WP; 1
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, C_6^+ \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_3\}; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- + \frac{(i\sqrt{3}-1)\sigma_+}{2};$		C-1 WP; 1
$\Delta; \Gamma A; C_6^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; \sqrt[3]{-1};$	
	$R_3;$	$1; (-1)^{2/3};$	
	$R_4;$	$1; -1;$	
	$R_5;$	$1; -\sqrt[3]{-1};$	
	$R_6;$	$1; -(-1)^{2/3};$	
$U; ML; C_2;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	
$P; KH; C_3^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; (-1)^{2/3};$	
	$R_3;$	$1; -\sqrt[3]{-1};$	
$T; \Gamma K; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S; AH; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$T'; MK; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S'; LH; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$\Sigma; \Gamma M; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$R; AL; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	

$\Gamma_h; \{C_6^+ | 00\frac{2}{3}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
	$\{R_3, R_5\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
	$R_4;$	$1; -1, 1;$	
$M; (0\frac{1}{2}0); C_2, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$R_2;$	$1; -1, 1;$	
$A; (00\frac{1}{2}); C_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
	$\{R_3, R_5\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
	$R_4;$	$1; -1, 1;$	
$L; (0\frac{1}{2}\frac{1}{2}); C_2, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$R_2;$	$1; -1, 1;$	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_6^+ \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- + \frac{(i\sqrt{3}-1)\sigma_+}{2};$	C-1 WP; 1
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^-, C_6^+ \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- - \frac{i\sqrt{3}+1}{2}\sigma_+;$	C-1 WP; 1
$\Delta; \Gamma A; C_6^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; \sqrt[3]{-1};$	
	$R_3;$	$1; (-1)^{2/3};$	
	$R_4;$	$1; -1;$	
	$R_5;$	$1; -\sqrt[3]{-1};$	
	$R_6;$	$1; -(-1)^{2/3};$	
$U; ML; C_2;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	
$P; KH; C_3^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; (-1)^{2/3};$	
	$R_3;$	$1; -\sqrt[3]{-1};$	
$T; \Gamma K; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S; AH; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$T'; MK; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S'; LH; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$\Sigma; \Gamma M; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$R; AL; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	

SG 173

 $\Gamma_h; \{C_6^+ | 00 \frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_6^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
	$\{R_3, R_5\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	C-2 WP; 2
$M; (0 \frac{1}{2} 0); C_2, \mathcal{T};$	$R_4;$	$1; -1, 1;$	
	$R_1;$	$1; 1, 1;$	
$A; (00 \frac{1}{2}); C_6^+, \mathcal{T};$	$R_2;$	$1; -1, 1;$	
	$\{R_2, R_{12}\};$	$2; \frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1;$	P-NS <sub>ALH</sub> ;
	$\{R_4, R_{10}\};$	$2; i\sigma_3, \sigma_1;$	P-NS <sub>ALH</sub> ;
$L; (0 \frac{1}{2} \frac{1}{2}); C_2, \mathcal{T};$	$\{R_6, R_8\};$	$2; \frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1;$	P-NS <sub>ALH</sub> ;
	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	P-NS <sub>ALH</sub> ;
$K; (\frac{1}{3} \frac{2}{3} 0); C_3^+, C_6^+ \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- + \frac{i\sqrt{3}-1}{2}\sigma_+;$	C-1 WP; 1
$H; (\frac{1}{3} \frac{2}{3} \frac{1}{2}); C_3^+, C_6^+ \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
	$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- + \frac{1-i\sqrt{3}}{2}\sigma_+;$	P-NS <sub>ALH</sub> ;
$\Delta; \Gamma A; C_6^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; \sqrt[3]{-1};$	
	$R_3;$	$1; (-1)^{2/3};$	
	$R_4;$	$1; -1;$	
	$R_5;$	$1; -\sqrt[3]{-1};$	
	$R_6;$	$1; -(-1)^{2/3};$	
$U; ML; C_2;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	
$P; KH; C_3^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; (-1)^{2/3};$	
	$R_3;$	$1; -\sqrt[3]{-1};$	
$T; \Gamma K; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S; AH; E, C_2 \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$T'; MK; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$S'; LH; E, C_2 \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$\Sigma; \Gamma M; E, C_2 \mathcal{T};$	$R_1;$	$1; 1, 1;$	
$R; AL; E, C_2 \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;

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 $\Gamma_h; \{S_3^+|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); S_3^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_6\}; 2;$	$\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-QNL $_{\Gamma A};$
	$\{R_3, R_5\}; 2;$	$\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-QNL $_{\Gamma A};$
	$R_4;$	$1; -1, 1;$	
$M; (0\frac{1}{2}0); \sigma_h, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$R_2;$	$1; -1, 1;$	
$A; (00\frac{1}{2}); S_3^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_6\}; 2;$	$\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-QNL $_{\Gamma A};$
	$\{R_3, R_5\}; 2;$	$\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-QNL $_{\Gamma A};$
	$R_4;$	$1; -1, 1;$	
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_h, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$R_2;$	$1; -1, 1;$	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; \sqrt[3]{-1};$	
	$R_3;$	$1; (-1)^{2/3};$	
	$R_4;$	$1; -1;$	
	$R_5;$	$1; -\sqrt[3]{-1};$	
	$R_6;$	$1; -(-1)^{2/3};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; \sqrt[3]{-1};$	
	$R_3;$	$1; (-1)^{2/3};$	
	$R_4;$	$1; -1;$	
	$R_5;$	$1; -\sqrt[3]{-1};$	
	$R_6;$	$1; -(-1)^{2/3};$	
$\Delta; \Gamma A; C_3^+, S_3^+, \mathcal{T};$	$R_1;$	$1; 1, 1;$	
	$\{R_2, R_3\}; 2;$	$\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_- - \frac{i\sqrt{3}+1}{2}\sigma_+;$	QNL; 0
$U; ML; E, \mathcal{T}\sigma_h;$	$R_1;$	$1; 1, 1;$	
$P; KH; C_3^+;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; (-1)^{2/3};$	
	$R_3;$	$1; -\sqrt[3]{-1};$	
$T; \Gamma K; \sigma_h;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	
$S; AH; \sigma_h;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	
$T'; MK; \sigma_h;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	
$S'; LH; \sigma_h;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	
$\Sigma; \Gamma M; \sigma_h;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	
$R; AL; \sigma_h;$	$R_1;$	$1; 1;$	
	$R_2;$	$1; -1;$	

$\Gamma_h; \{C_3^+|000\}, \{C_2|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_3^+, C_2, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
	$R_4;$	1; 1, -1, 1, 1;		
	$\{R_5, R_6\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, -\sigma_0, \sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
	$R_7;$	1; 1, 1, -1, 1;		
	$\{R_8, R_9\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0, -\sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0); C_2, I, \mathcal{T};$	$R_{10};$	1; 1, -1, -1, 1;		
	$\{R_{11}, R_{12}\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, -\sigma_0, -\sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
$A; (00\frac{1}{2}); C_3^+, C_2, I, \mathcal{T};$	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_1;$	1; 1, 1, 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
	$R_4;$	1; 1, -1, 1, 1;		
	$\{R_5, R_6\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, -\sigma_0, \sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
$L; (0\frac{1}{2}\frac{1}{2}); C_2, I, \mathcal{T};$	$R_7;$	1; 1, 1, -1, 1;		
	$\{R_8, R_9\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0, -\sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
	$R_{10};$	1; 1, -1, -1, 1;		
	$\{R_{11}, R_{12}\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, -\sigma_0, -\sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, I\mathcal{T};$	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_1;$	1; 1, 1;		
	$\{R_2, R_6\};$	2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+, I\mathcal{T};$	$\{R_3, R_5\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNL $_{KH};$	
	$R_4;$	1; -1, 1;		
	$R_1;$	1; 1, 1;		
	$\{R_2, R_6\};$	2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNL $_{KH};$	
$\Delta; \Gamma A; C_6^+, I\mathcal{T};$	$\{R_3, R_5\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNL $_{KH};$	
	$R_4;$	1; -1, 1;		
	$R_1;$	1; 1, 1;		
	$\{R_2, R_6\};$	2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	QNL;	0
$U; ML; C_2, I\mathcal{T};$	$\{R_3, R_5\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	QNL;	0
	$R_4;$	1; -1, 1;		
	$R_1;$	1; 1, 1;		
$P; KH; C_3^+, I\mathcal{T};$	$R_2;$	1; -1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	WNL;	$\pi$
$T; \Gamma K; \sigma_h, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; AH; \sigma_h, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		



$$\begin{array}{l} T'; \text{ MK}; \sigma_h, I\mathcal{T}; R_1; 1; 1, 1; \\ \qquad R_2; 1; -1, 1; \\ S'; \text{ LH}; \sigma_h, I\mathcal{T}; R_1; 1; 1, 1; \\ \qquad R_2; 1; -1, 1; \\ \Sigma; \text{ } \Gamma\text{M}; \sigma_h, I\mathcal{T}; R_1; 1; 1, 1; \\ \qquad R_2; 1; -1, 1; \\ R; \text{ AL}; \sigma_h, I\mathcal{T}; R_1; 1; 1, 1; \\ \qquad R_2; 1; -1, 1; \end{array}$$

$\Gamma_h; \{C_3^+|000\}, \{C_2|00\frac{1}{2}\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_3^+, C_2, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
	$R_4;$	1; 1, -1, 1, 1;		
	$\{R_5, R_6\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, -\sigma_0, \sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
	$R_7;$	1; 1, 1, -1, 1;		
	$\{R_8, R_9\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0, -\sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
	$R_{10};$	1; 1, -1, -1, 1;		
	$\{R_{11}, R_{12}\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, -\sigma_0, -\sigma_0, \sigma_1;$	P-QNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0); C_2, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$A; (00\frac{1}{2}); C_6^+, I, \mathcal{T};$	$\{R_{13}, R_{15}\};$	4; $\frac{\sqrt{3}\Gamma_{0,3}+i\Gamma_{3,3}}{2}, \Gamma_{0,1}, \Gamma_{1,0};$	QDP;	0
	$R_{14};$	2; $i\sigma_3, \sigma_1, -i\sigma_1;$	P-NS $_{ALH};$	
$L; (0\frac{1}{2}\frac{1}{2}); C_2, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS $_{ALH};$	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$\{R_2, R_6\};$	2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNL $_{KH};$	
	$\{R_3, R_5\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	P-WNL $_{KH};$	
	$R_4;$	1; -1, 1;		
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+, I\mathcal{T};$	$\{R_1, R_4\};$	2; $\sigma_3, \sigma_1;$	P-NS $_{ALH};$	
	$\{R_2, R_3\};$	2; $\frac{\sigma_3+i\sqrt{3}\sigma_0}{2}, \sigma_1;$	P-WNL/NS;	
	$\{R_5, R_6\};$	2; $-\frac{\sigma_3}{2} - \frac{1}{2}i\sqrt{3}\sigma_0, \sigma_1;$	P-WNL/NS;	
$\Delta; \Gamma A; C_6^+, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$\{R_2, R_6\};$	2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	QNL;	0
	$\{R_3, R_5\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	QNL;	0
	$R_4;$	1; -1, 1;		
$U; ML; C_2, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$P; KH; C_3^+, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_1;$	WNL;	$\pi$
$T; \Gamma K; \sigma_h, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; AH; \sigma_h, I\mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS $_{ALH};$	
$T'; MK; \sigma_h, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S'; LH; \sigma_h, I\mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS $_{ALH};$	
$\Sigma; \Gamma M; \sigma_h, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$R; AL; \sigma_h, I\mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS $_{ALH};$	

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 $\Gamma_h; \{C_6^+|000\}, \{C_{21}'|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_6^+, C_{21}', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (0\frac{1}{2}0); C_2, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$A; (00\frac{1}{2}); C_6^+, C_{21}', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$L; (0\frac{1}{2}\frac{1}{2}); C_2, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2};$	C-1 WP; 1
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2};$	C-1 WP; 1
$\Delta; \Gamma A; C_6^+, C_{23}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; \sqrt[3]{-1}, 1;$	
	$R_3; 1; (-1)^{2/3}, 1;$	
	$R_4; 1; -1, 1;$	
	$R_5; 1; -\sqrt[3]{-1}, 1;$	
	$R_6; 1; -(-1)^{2/3}, 1;$	
$U; ML; C_2, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$P; KH; C_3^+, C_{22}', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1;$	
$T; \Gamma K; C_{22}'', C_{22}', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$S; AH; C_{22}'', C_{22}', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$T'; MK; C_{21}'', C_2 \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$S'; LH; C_{21}'', C_2 \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	

$$\begin{array}{l} \Sigma; \text{ FM}; C'_{21}, C''_{21} \mathcal{T}; R_1; 1; 1, 1; \\ \qquad R_2; 1; -1, 1; \\ R; \text{ AL}; C'_{21}, C''_{21} \mathcal{T}; R_1; 1; 1, 1; \\ \qquad R_2; 1; -1, 1; \end{array}$$

$\Gamma_h; \{C_6^+|00\frac{1}{6}\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_6^+, C_{21}', \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (0\frac{1}{2}0); C_2, C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$A; (00\frac{1}{2}); C_6^+, C_{21}', \mathcal{T};$	$R_7;$	2; $\frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1, -i\sigma_1;$	P-NS <sub>ALH</sub> ;
	$R_8;$	2; $\frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1, -i\sigma_1;$	P-NS <sub>ALH</sub> ;
	$R_9;$	2; $i\sigma_3, \sigma_1, -i\sigma_1;$	P-NS <sub>ALH</sub> ;
$L; (0\frac{1}{2}\frac{1}{2}); C_2, C_{21}'', \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ALH</sub> ;
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2};$	C-1 WP; 1
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^-, C_{21}'', C_6^+ \mathcal{T}; \{R_1, R_2\};$	$R_1, R_2;$	2; $\sigma_0, \sigma_3, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sqrt{3}\sigma_0 + i\sigma_2}{2};$	P-NS <sub>ALH</sub> ;
$\Delta; \Gamma A; C_6^+, C_{23}'', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $\sqrt[3]{-1}, 1;$	
	$R_3;$	1; $(-1)^{2/3}, 1;$	
	$R_4;$	1; -1, 1;	
	$R_5;$	1; $-\sqrt[3]{-1}, 1;$	
	$R_6;$	1; $-(-1)^{2/3}, 1;$	
$U; ML; C_2, C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$P; KH; C_3^+, C_{22}', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $(-1)^{2/3}, 1;$	
	$R_3;$	1; $-\sqrt[3]{-1}, 1;$	
$T; \Gamma K; C_{22}'', C_{22}', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S; AH; C_{22}'', C_{22}', \mathcal{T};$	$\{R_2, R_8\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ALH</sub> ;
$T'; MK; C_{21}'', C_2 \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S'; LH; C_{21}'', C_2 \mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$\Sigma; \Gamma M; C_{21}', C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$R; AL; C_{21}', C_{21}'', \mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ALH</sub> ;

$\Gamma_h; \{C_6^+|00\frac{5}{6}\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_6^+, C_{21}', \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (0\frac{1}{2}0); C_2, C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$A; (00\frac{1}{2}); C_6^+, C_{21}', \mathcal{T};$	$R_7;$	2; $\frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1, -i\sigma_1;$	P-NS <sub>ALH</sub> ;
	$R_8;$	2; $\frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1, -i\sigma_1;$	P-NS <sub>ALH</sub> ;
	$R_9;$	2; $i\sigma_3, \sigma_1, -i\sigma_1;$	P-NS <sub>ALH</sub> ;
$L; (0\frac{1}{2}\frac{1}{2}); C_2, C_{21}'', \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ALH</sub> ;
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2};$	C-1 WP; 1
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_0, \sigma_3, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sqrt{3}\sigma_0 - i\sigma_2}{2};$	P-NS <sub>ALH</sub> ;
$\Delta; \Gamma A; C_6^+, C_{23}'', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $\sqrt[3]{-1}, 1;$	
	$R_3;$	1; $(-1)^{2/3}, 1;$	
	$R_4;$	1; -1, 1;	
	$R_5;$	1; $-\sqrt[3]{-1}, 1;$	
	$R_6;$	1; $-(-1)^{2/3}, 1;$	
$U; ML; C_2, C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$P; KH; C_3^+, C_{22}', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $(-1)^{2/3}, 1;$	
	$R_3;$	1; $-\sqrt[3]{-1}, 1;$	
$T; \Gamma K; C_{22}'', C_{22}', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S; AH; C_{22}'', C_{22}', \mathcal{T};$	$\{R_2, R_8\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ALH</sub> ;
$T'; MK; C_{21}'', C_2 \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S'; LH; C_{21}'', C_2 \mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$\Sigma; \Gamma M; C_{21}', C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$R; AL; C_{21}', C_{21}'', \mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ALH</sub> ;

$\Gamma_h; \{C_6^+|00\frac{1}{3}\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_6^+, C_{21}', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (0\frac{1}{2}0); C_2, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$A; (00\frac{1}{2}); C_6^+, C_{21}', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$L; (0\frac{1}{2}\frac{1}{2}); C_2, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2};$	C-1 WP; 1
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2};$	C-1 WP; 1
$\Delta; \Gamma A; C_6^+, C_{23}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; \sqrt[3]{-1}, 1;$	
	$R_3; 1; (-1)^{2/3}, 1;$	
	$R_4; 1; -1, 1;$	
	$R_5; 1; -\sqrt[3]{-1}, 1;$	
	$R_6; 1; -(-1)^{2/3}, 1;$	
$U; ML; C_2, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$P; KH; C_3^+, C_{22}', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1;$	
$T; \Gamma K; C_{22}'', C_{22}', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$S; AH; C_{22}'', C_{22}', \mathcal{T};$	$R_2; 1; 1, 1;$	
	$R_5; 1; -1, 1;$	
$T'; MK; C_{21}'', C_2 \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$S'; LH; C_{21}'', C_2 \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	

$$\begin{array}{l} \Sigma; \text{ FM}; C'_{21}, C''_{21} \mathcal{T}; R_1; 1; 1, 1; \\ \qquad R_2; 1; -1, 1; \\ R; \text{ AL}; C'_{21}, C''_{21} \mathcal{T}; R_1; 1; 1, 1; \\ \qquad R_2; 1; -1, 1; \end{array}$$



SG 181

 $\Gamma_h; \{C_6^+|00\frac{2}{3}\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma;$ (000); $C_6^+, C_{21}', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M;$ (0 $\frac{1}{2}$ 0); $C_2, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$A;$ (00 $\frac{1}{2}$ ); $C_6^+, C_{21}', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$L;$ (0 $\frac{1}{2}$ $\frac{1}{2}$ ); $C_2, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$K;$ ( $\frac{1}{3}$ $\frac{2}{3}$ 0); $C_3^-, C_{21}'', C_6^+ \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2};$	C-1 WP; 1
$H;$ ( $\frac{1}{3}$ $\frac{2}{3}$ $\frac{1}{2}$ ); $C_3^-, C_{21}'', C_6^+ \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2};$	C-1 WP; 1
$\Delta;$ $\Gamma A;$ $C_6^+, C_{23}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; \sqrt[3]{-1}, 1;$	
	$R_3; 1; (-1)^{2/3}, 1;$	
	$R_4; 1; -1, 1;$	
	$R_5; 1; -\sqrt[3]{-1}, 1;$	
	$R_6; 1; -(-1)^{2/3}, 1;$	
$U;$ ML; $C_2, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$P;$ KH; $C_3^+, C_{22}', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1;$	
$T;$ $\Gamma K;$ $C_{22}'', C_{22}', \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$S;$ AH; $C_{22}'', C_{22}', \mathcal{T};$	$R_3; 1; 1, 1;$	
	$R_6; 1; -1, 1;$	

$$\begin{array}{l} T'; \text{ MK}; C''_{21}, C_2 \mathcal{T}; \quad R_1; 1; 1, 1; \\ \qquad \qquad \qquad R_2; 1; -1, 1; \\ S'; \text{ LH}; C''_{21}, C_2 \mathcal{T}; \quad R_1; 1; 1, 1; \\ \qquad \qquad \qquad R_2; 1; -1, 1; \\ \Sigma; \text{ } \Gamma \text{M}; C'_{21}, C''_{21} \mathcal{T}; R_1; 1; 1, 1; \\ \qquad \qquad \qquad R_2; 1; -1, 1; \\ R; \text{ AL}; C'_{21}, C''_{21} \mathcal{T}; R_1; 1; 1, 1; \\ \qquad \qquad \qquad R_2; 1; -1, 1; \end{array}$$

SG 182

 $\Gamma_h; \{C_6^+|00\frac{1}{2}\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_6^+, C_{21}', \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (0\frac{1}{2}0); C_2, C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
$A; (00\frac{1}{2}); C_6^+, C_{21}', \mathcal{T};$	$R_7;$	2; $\frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1, -i\sigma_1;$	P-NS <sub>ALH</sub> ;
	$R_8;$	2; $\frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_1, -i\sigma_1;$	P-NS <sub>ALH</sub> ;
	$R_9;$	2; $i\sigma_3, \sigma_1, -i\sigma_1;$	P-NS <sub>ALH</sub> ;
$L; (0\frac{1}{2}\frac{1}{2}); C_2, C_{21}'', \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>ALH</sub> ;
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2};$	C-1 WP; 1
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_0, \sigma_3, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sqrt{3}\sigma_0 - i\sigma_2}{2};$	P-NS <sub>ALH</sub> ;
$\Delta; \Gamma A; C_6^+, C_{23}'', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $\sqrt[3]{-1}, 1;$	
	$R_3;$	1; $(-1)^{2/3}, 1;$	
	$R_4;$	1; -1, 1;	
	$R_5;$	1; $-\sqrt[3]{-1}, 1;$	
	$R_6;$	1; $-(-1)^{2/3}, 1;$	
$U; ML; C_2, C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$P; KH; C_3^+, C_{22}', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $(-1)^{2/3}, 1;$	
	$R_3;$	1; $-\sqrt[3]{-1}, 1;$	
$T; \Gamma K; C_{22}'', C_{22}', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S; AH; C_{22}'', C_{22}', \mathcal{T};$	$\{R_2, R_8\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ALH</sub> ;
$T'; MK; C_{21}'', C_2 \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S'; LH; C_{21}'', C_2 \mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$\Sigma; \Gamma M; C_{21}', C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$R; AL; C_{21}', C_{21}'', \mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>ALH</sub> ;

$\Gamma_h; \{C_6^+|000\}, \{\sigma_{v1}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_6^+, \sigma_{v1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 1; -1, 1, 1;$		
	$R_4; 1; -1, -1, 1;$		
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A};$	
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0); C_2, \sigma_{v1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 1; -1, 1, 1;$		
	$R_4; 1; -1, -1, 1;$		
$A; (00\frac{1}{2}); C_6^+, \sigma_{v1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 1; -1, 1, 1;$		
	$R_4; 1; -1, -1, 1;$		
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A};$	
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A};$	
$L; (0\frac{1}{2}\frac{1}{2}); C_2, \sigma_{v1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 1; -1, 1, 1;$		
	$R_4; 1; -1, -1, 1;$		
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, \sigma_{d1}, C_6^+ \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2};$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, \sigma_{d1}, C_6^+ \mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2};$	P-WNL $_{KH};$	
$\Delta; \Gamma A; C_6^+, \sigma_{v1};$	$R_1; 1; 1, 1;$		
	$R_2; 1; 1, -1;$		
	$R_3; 1; -1, 1;$		
	$R_4; 1; -1, -1;$		
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	QNL;	0
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	QNL;	0
$U; ML; C_2, \sigma_{v1};$	$R_1; 1; 1, 1;$		
	$R_2; 1; 1, -1;$		
	$R_3; 1; -1, 1;$		
	$R_4; 1; -1, -1;$		
$P; KH; C_3^+, \sigma_{d1};$	$R_1; 1; 1, 1;$		
	$R_2; 1; 1, -1;$		
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$T; \Gamma K; \sigma_{d2}, \mathcal{T} \sigma_{v2};$	$R_1; 1; 1, 1;$		
	$R_2; 1; -1, 1;$		
$S; AH; \sigma_{d2}, \mathcal{T} \sigma_{v2};$	$R_1; 1; 1, 1;$		
	$R_2; 1; -1, 1;$		

$$\begin{array}{l} T'; \text{ MK}; \sigma_{d1}, C_2 \mathcal{T}; \quad R_1; 1; 1, 1; \\ \qquad \qquad \qquad R_2; 1; -1, 1; \\ S'; \text{ LH}; \sigma_{d1}, C_2 \mathcal{T}; \quad R_1; 1; 1, 1; \\ \qquad \qquad \qquad R_2; 1; -1, 1; \\ \Sigma; \text{ } \Gamma \text{M}; \sigma_{v1}, \mathcal{T} \sigma_{d1}; \quad R_1; 1; 1, 1; \\ \qquad \qquad \qquad R_2; 1; -1, 1; \\ R; \text{ AL}; \sigma_{v1}, \mathcal{T} \sigma_{d1}; \quad R_1; 1; 1, 1; \\ \qquad \qquad \qquad R_2; 1; -1, 1; \end{array}$$

$\Gamma_h; \{C_6^+|000\}, \{\sigma_{v1}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_6^+, \sigma_{v1}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A};$	
	$R_6;$	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0); C_2, \sigma_{v1}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$A; (00\frac{1}{2}); C_3^+, \sigma_{v1}, C_2, \mathcal{T}; \{R_3, R_4\};$		2; $-\sigma_0, i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_6, R_6\};$	4; $\frac{\Gamma_{0,0}-i\sqrt{3}\Gamma_{0,2}}{2}, i\Gamma_{0,3}, \Gamma_{0,0}, -\Gamma_{2,2};$	QDP;	0
	$\{R_9, R_{10}\};$	2; $-\sigma_0, i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_{12}, R_{12}\};$	4; $\frac{\Gamma_{0,0}-i\sqrt{3}\Gamma_{0,2}}{2}, i\Gamma_{0,3}, -\Gamma_{0,0}, -\Gamma_{2,2};$	QDP;	0
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{v1}, C_2, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-WNLs;	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, \sigma_{d1}, C_6^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	2; $\frac{-\sigma_0-i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0+i\sqrt{3}\sigma_2}{2};$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, \sigma_{d1}, C_6^+ \mathcal{T}; \{R_3, R_4\};$		2; $-\sigma_0, i\sigma_3, \sigma_1;$	P-WNLs;	
	$\{R_6, R_6\};$	4; $\frac{\Gamma_{0,0}-i\sqrt{3}\Gamma_{0,2}}{2}, i\Gamma_{0,3}, \frac{\Gamma_{2,2}+i\sqrt{3}\Gamma_{2,0}}{2};$	DP;	0
$\Delta; \Gamma A; C_6^+, \sigma_{v1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3;$	QNL;	0
	$R_6;$	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3;$	QNL;	0
$U; ML; C_2, \sigma_{v1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$P; KH; C_3^+, \sigma_{d1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3;$	WNL;	$\pi$
$T; \Gamma K; \sigma_{d2}, \mathcal{T} \sigma_{v2};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; AH; \sigma_{d2}, \mathcal{T} \sigma_{v2};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$T'; MK; \sigma_{d1}, C_2 \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S'; LH; \sigma_{d1}, C_2 \mathcal{T};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma M; \sigma_{v1}, \mathcal{T} \sigma_{d1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$R; AL; \sigma_{v1}, \mathcal{T} \sigma_{d1};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$

SG 185

 $\Gamma_h; \{C_6^+|00\frac{1}{2}\}, \{\sigma_{v1}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_6^+, \sigma_{v1}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A};$	
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0); C_2, \sigma_{v1}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$A; (00\frac{1}{2}); C_3^+, \sigma_{d1}, C_2, \mathcal{T}; \{R_4, R_{10}\};$	2; $\sigma_0, \sigma_0, i\sigma_3, \sigma_1;$		P-NS $_{ALH};$	
	$\{R_5, R_{11}\};$	2; $\sigma_0, -\sigma_0, i\sigma_3, \sigma_1;$	P-NS $_{ALH};$	
	$\{R_6, R_{12}\};$	4; $\frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2}}{2}, \Gamma_{0,3}, i\Gamma_{3,0}, \Gamma_{1,0};$	QDP;	0
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{v1}, \sigma_{d1}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NS $_{ALH};$	
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NS $_{ALH};$	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, \sigma_{d1}, C_6^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2};$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, \sigma_{d1}, C_6^+, \mathcal{T}; \{R_1, R_1\};$	2; $\sigma_0, \sigma_0, -i\sigma_2;$		P-NS $_{ALH};$	
	$\{R_2, R_2\};$	2; $\sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ALH};$	
	$\{R_3, R_3\};$	4; $\frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2}}{2}, \Gamma_{0,3}, \frac{\sqrt{3}\Gamma_{2,2} + i\Gamma_{2,0}}{2};$	DP;	0
$\Delta; \Gamma A; C_6^+, \sigma_{v1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	QNL;	0
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	QNL;	0
$U; ML; C_2, \sigma_{v1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$P; KH; C_3^+, \sigma_{d1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$T; \Gamma K; \sigma_{d2}, \mathcal{T}\sigma_{v2};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; AH; \sigma_{d2}, \mathcal{T}\sigma_{v2};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	L-NS $_{ALH};$	
	$\{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	L-NS $_{ALH};$	
$T'; MK; \sigma_{d1}, C_2\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S'; LH; \sigma_{d1}, C_2\mathcal{T};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	L-NS $_{ALH};$	
	$\{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	L-NS $_{ALH};$	
$\Sigma; \Gamma M; \sigma_{v1}, \mathcal{T}\sigma_{d1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$R; AL; \sigma_{v1}, \mathcal{T}\sigma_{d1};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	L-NS $_{ALH};$	

$\Gamma_h; \{C_6^+|00\frac{1}{2}\}, \{\sigma_{v1}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); C_6^+, \sigma_{v1}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$ ;	
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$ ;	
$M; (0\frac{1}{2}0); C_2, \sigma_{v1}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$A; (00\frac{1}{2}); C_3^+, \sigma_{v1}, C_2, \mathcal{T}; \{R_4, R_{10}\};$	2; $\sigma_0, \sigma_0, i\sigma_3, \sigma_1;$		P-NS $_{ALH}$ ;	
	$\{R_5, R_{11}\};$	2; $\sigma_0, -\sigma_0, i\sigma_3, \sigma_1;$	P-NS $_{ALH}$ ;	
	$\{R_6, R_{12}\};$	4; $\frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2}}{2}, \Gamma_{0,3}, i\Gamma_{3,0}, \Gamma_{1,0};$	QDP;	0
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{d1}, \sigma_{v1}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NS $_{ALH}$ ;	
	$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NS $_{ALH}$ ;	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, \sigma_{d1}, C_6^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2};$	P-WNL $_{KH}$ ;	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, \sigma_{d1}, C_6^+, \mathcal{T}; \{R_3, R_4\};$	2; $-\sigma_0, i\sigma_3, -i\sigma_2;$		P-NS $_{ALH}$ ;	
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{-\sqrt{3}\sigma_0 + i\sigma_2}{2};$	P-WNL/NS;	
$\Delta; \Gamma A; C_6^+, \sigma_{v1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	QNL;	0
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	QNL;	0
$U; ML; C_2, \sigma_{v1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$P; KH; C_3^+, \sigma_{d1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$T; \Gamma K; \sigma_{d2}, \mathcal{T}\sigma_{v2};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; AH; \sigma_{d2}, \mathcal{T}\sigma_{v2};$	$\{R_1, R_2\};$	2; $-i\sigma_3, \sigma_1;$	L-NS $_{ALH}$ ;	
$T'; MK; \sigma_{d1}, C_2, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S'; LH; \sigma_{d1}, C_2, \mathcal{T};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	L-NS $_{ALH}$ ;	
$\Sigma; \Gamma M; \sigma_{v1}, \mathcal{T}\sigma_{d1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$R; AL; \sigma_{v1}, \mathcal{T}\sigma_{d1};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	L-NS $_{ALH}$ ;	
	$\{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	L-NS $_{ALH}$ ;	



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 $\Gamma_h; \{S_3^+|000\}, \{C'_{21}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); S_3^+, C'_{21}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$
$M; (0\frac{1}{2}0); C'_{21}, \sigma_{v1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$A; (00\frac{1}{2}); S_3^+, C'_{21}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$
$L; (0\frac{1}{2}\frac{1}{2}); C'_{21}, \sigma_{v1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, \mathcal{T}\sigma_{v2};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; \sqrt[3]{-1}, 1;$	
	$R_3; 1; (-1)^{2/3}, 1;$	
	$R_4; 1; -1, 1;$	
	$R_5; 1; -\sqrt[3]{-1}, 1;$	
	$R_6; 1; -(-1)^{2/3}, 1;$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+, \mathcal{T}\sigma_{v2};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; \sqrt[3]{-1}, 1;$	
	$R_3; 1; (-1)^{2/3}, 1;$	
	$R_4; 1; -1, 1;$	
	$R_5; 1; -\sqrt[3]{-1}, 1;$	
	$R_6; 1; -(-1)^{2/3}, 1;$	
$\Delta; \Gamma A; C_3^+, \sigma_{v1}, S_3^+, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2};$	QNL; 0
$U; ML; \sigma_{v1}, \mathcal{T}\sigma_h;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; -1, 1;$	
$P; KH; C_3^+, C'_{23}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1;$	
$T; \Gamma K; \sigma_h, \mathcal{T}\sigma_{v2};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; -1, 1;$	
$S; AH; \sigma_h, \mathcal{T}\sigma_{v2};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; -1, 1;$	

$$\begin{aligned}
&T'; \text{ MK}; \sigma_h, \mathcal{T}\sigma_{v1}; R_1; 1; 1, 1; \\
&\quad R_2; 1; -1, 1; \\
&S'; \text{ LH}; \sigma_h, \mathcal{T}\sigma_{v1}; R_1; 1; 1, 1; \\
&\quad R_2; 1; -1, 1; \\
&\Sigma; \text{ GM}; C'_{21, \sigma_{v1}}; R_1; 1; 1, 1; \\
&\quad R_2; 1; 1, -1; \\
&\quad R_3; 1; -1, 1; \\
&\quad R_4; 1; -1, -1; \\
&R; \text{ AL}; C'_{21, \sigma_{v1}}; R_1; 1; 1, 1; \\
&\quad R_2; 1; 1, -1; \\
&\quad R_3; 1; -1, 1; \\
&\quad R_4; 1; -1, -1;
\end{aligned}$$

SG 188

 $\Gamma_h; \{S_3^+|000\}, \{C'_{21}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); S_3^+, C'_{21}, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$1; -1, 1, 1;$		
	$R_4;$	$1; -1, -1, 1;$		
	$R_5;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$	
	$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$	
$M; (0\frac{1}{2}0); C'_{21}, \sigma_{v1}, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$1; -1, 1, 1;$		
	$R_4;$	$1; -1, -1, 1;$		
$A; (00\frac{1}{2}); \sigma_{v1}, C_3^+, \sigma_h, \mathcal{T}; \{R_7, R_8\};$	$4; -i\Gamma_{3,1}, \frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,3}, \Gamma_{1,0};$	QDP;	0	
	$R_9;$	$2; i\sigma_1, \sigma_0, \sigma_3, -i\sigma_3;$	P-WNLs;	
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{v1}, \sigma_h, \mathcal{T};$	$R_5;$	$2; i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, \mathcal{T}\sigma_{v2};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; \sqrt[3]{-1}, 1;$		
	$R_3;$	$1; (-1)^{2/3}, 1;$		
	$R_4;$	$1; -1, 1;$		
	$R_5;$	$1; -\sqrt[3]{-1}, 1;$		
	$R_6;$	$1; -(-1)^{2/3}, 1;$		
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+, \mathcal{T}\sigma_{v2};$	$\{R_1, R_4\};$	$2; \sigma_3, -i\sigma_2;$	P-WNLs;	
	$\{R_2, R_5\};$	$2; \sqrt[3]{-1}\sigma_3, -i\sigma_2;$	P-WNLs;	
	$\{R_3, R_6\};$	$2; (-1)^{2/3}\sigma_3, -i\sigma_2;$	P-WNLs;	
$\Delta; \Gamma A; C_3^+, \sigma_{v1}, S_3^+, \mathcal{T};$	$R_1;$	$1; 1, 1, 1;$		
	$R_2;$	$1; 1, -1, 1;$		
	$R_3;$	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2};$	QNL;	0
$U; ML; \sigma_{v1}, \mathcal{T}\sigma_h;$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$P; KH; C_3^+, C'_{23}, \mathcal{T};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; (-1)^{2/3}, 1;$		
	$R_3;$	$1; -\sqrt[3]{-1}, 1;$		
$T; \Gamma K; \sigma_h, \mathcal{T}\sigma_{v2};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$S; AH; \sigma_h, \mathcal{T}\sigma_{v2};$	$\{R_1, R_2\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$T'; MK; \sigma_h, \mathcal{T}\sigma_{v1};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; -1, 1;$		
$S'; LH; \sigma_h, \mathcal{T}\sigma_{v1};$	$\{R_1, R_2\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Sigma; \Gamma M; C'_{21}, \sigma_{v1};$	$R_1;$	$1; 1, 1;$		
	$R_2;$	$1; 1, -1;$		
	$R_3;$	$1; -1, 1;$		
	$R_4;$	$1; -1, -1;$		
$R; AL; C'_{21}, \sigma_h;$	$R_5;$	$2; \sigma_2, \sigma_3;$	WNL;	$\pi$

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 $\Gamma_h; \{S_3^+|000\}, \{C_{21}''|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$\Gamma; (000); S_3^+, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$
$M; (0\frac{1}{2}0); C_{21}'', \sigma_{d1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$A; (00\frac{1}{2}); S_3^+, C_{21}'', \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$
$L; (0\frac{1}{2}\frac{1}{2}); C_{21}'', \sigma_{d1}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, C_{21}'';$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1;$	
	$R_3; 1; -1, 1;$	
	$R_4; 1; -1, -1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	P-WNL $_{KH}$
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	P-WNL $_{KH}$
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+, C_{21}'';$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1;$	
	$R_3; 1; -1, 1;$	
	$R_4; 1; -1, -1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	P-WNL $_{KH}$
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	P-WNL $_{KH}$
$\Delta; \Gamma A; C_3^+, \sigma_{d1}, S_3^+ \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2};$	QNL; 0
$U; ML; \sigma_{d1}, \mathcal{T} \sigma_h;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; -1, 1;$	
$P; KH; C_3^+, \sigma_{d1};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL; $\pi$
$T; \Gamma K; C_{22}'', \sigma_{d2};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1;$	
	$R_3; 1; -1, 1;$	
	$R_4; 1; -1, -1;$	

$$\begin{aligned}
S; \text{ AH}; C''_{22, \sigma_{d2}}; & R_1; 1; 1, 1; \\
& R_2; 1; 1, -1; \\
& R_3; 1; -1, 1; \\
& R_4; 1; -1, -1; \\
T'; \text{ MK}; C''_{21, \sigma_{d1}}; & R_1; 1; 1, 1; \\
& R_2; 1; 1, -1; \\
& R_3; 1; -1, 1; \\
& R_4; 1; -1, -1; \\
S'; \text{ LH}; C''_{21, \sigma_{d1}}; & R_1; 1; 1, 1; \\
& R_2; 1; 1, -1; \\
& R_3; 1; -1, 1; \\
& R_4; 1; -1, -1; \\
\Sigma; \text{ GM}; \sigma_h, \mathcal{T}\sigma_{d1}; & R_1; 1; 1, 1; \\
& R_2; 1; -1, 1; \\
R; \text{ AL}; \sigma_h, \mathcal{T}\sigma_{d1}; & R_1; 1; 1, 1; \\
& R_2; 1; -1, 1;
\end{aligned}$$

SG 190

 $\Gamma_h; \{S_3^+|000\}, \{C_{21}''|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); S_3^+, C_{21}'', \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$	
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma A}$	
$M; (0\frac{1}{2}0); C_{21}'', \sigma_{d1}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$A; (00\frac{1}{2}); \sigma_{d1}, C_3^+, \sigma_h, \mathcal{T}; \{R_7, R_8\};$	4; $-i\Gamma_{3,1}, \frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,3}, \Gamma_{1,0};$	QDP;	0	
	$R_9;$	2; $i\sigma_1, \sigma_0, \sigma_3, -i\sigma_3;$	P-WNLs;	
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{d1}, \sigma_h, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, C_{21}'';$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	P-WNL $_{KH}$	
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	P-WNL $_{KH}$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); \sigma_{d1}, C_3^+, \sigma_h;$	$R_7;$	2; $-i\sigma_1, \frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_3;$	P-WNLs;	
	$R_8;$	2; $i\sigma_1, \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_3;$	P-WNLs;	
	$R_9;$	2; $i\sigma_1, \sigma_0, \sigma_3;$	P-WNLs;	
$\Delta; \Gamma A; C_3^+, \sigma_{d1}, S_3^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2};$	QNL;	0
$U; ML; \sigma_{d1}, \mathcal{T}\sigma_h;$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$P; KH; C_3^+, \sigma_{d1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$T; \Gamma K; C_{22}'', \sigma_{d2};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$S; AH; C_{22}'', \sigma_h;$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$
$T'; MK; C_{21}'', \sigma_{d1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
$S'; LH; C_{21}'', \sigma_h;$	$R_5;$	2; $\sigma_2, \sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma M; \sigma_h, \mathcal{T}\sigma_{d1};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$R; AL; \sigma_h, \mathcal{T}\sigma_{d1};$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$

SG 191

 $\Gamma_h; \{C_3^+|000\}, \{C'_{21}|000\}, \{C_2|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_3^+, C'_{21}, C_2, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
	$R_2; 1; 1, -1, 1, 1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \sigma_0, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$
	$R_4; 1; 1, 1, -1, 1, 1;$	
	$R_5; 1; 1, -1, -1, 1, 1;$	
	$R_6; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$
	$R_7; 1; 1, 1, 1, -1, 1;$	
	$R_8; 1; 1, -1, 1, -1, 1;$	
	$R_9; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \sigma_0, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$
	$R_{10}; 1; 1, 1, -1, -1, 1;$	
	$R_{11}; 1; 1, -1, -1, -1, 1;$	
	$R_{12}; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$
$M; (0\frac{1}{2}0); C_2, C''_{21}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; -1, 1, 1, 1;$	
	$R_3; 1; 1, -1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 1; 1, 1, -1, 1;$	
	$R_6; 1; -1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, -1, -1, 1;$	
$A; (00\frac{1}{2}); C_3^+, C'_{21}, C_2, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
	$R_2; 1; 1, -1, 1, 1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \sigma_0, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$
	$R_4; 1; 1, 1, -1, 1, 1;$	
	$R_5; 1; 1, -1, -1, 1, 1;$	
	$R_6; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$
	$R_7; 1; 1, 1, 1, -1, 1;$	
	$R_8; 1; 1, -1, 1, -1, 1;$	
	$R_9; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \sigma_0, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$
	$R_{10}; 1; 1, 1, -1, -1, 1;$	
	$R_{11}; 1; 1, -1, -1, -1, 1;$	
	$R_{12}; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$
$L; (0\frac{1}{2}\frac{1}{2}); C_2, C''_{21}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; -1, 1, 1, 1;$	
	$R_3; 1; 1, -1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 1; 1, 1, -1, 1;$	
	$R_6; 1; -1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, -1, -1, 1;$	

$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, C_{21}'', IT;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL <sub>KH</sub> ;
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL <sub>KH</sub> ;
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+, C_{21}'', IT;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL <sub>KH</sub> ;
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL <sub>KH</sub> ;
$\Delta; \Gamma A; C_6^+, \sigma_{v1}, IT;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	QNL; 0
	$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	QNL; 0
$U; ML; C_2, \sigma_{v1}, IT;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$P; KH; C_3^+, \sigma_{d1}, IT;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	WNL; $\pi$
$T; \Gamma K; C_{22}'', \sigma_{d2}, IT;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$S; AH; C_{22}'', \sigma_{d2}, IT;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$T'; MK; C_{21}'', \sigma_{d1}, IT;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$S'; LH; C_{21}'', \sigma_{d1}, IT;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$\Sigma; \Gamma M; C_{21}'', \sigma_{v1}, IT;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$R; AL; C_{21}', \sigma_{v1}, IT;$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	



$\Gamma_h; \{C_3^+|000\}, \{C_{21}'|00\frac{1}{2}\}, \{C_2|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_3^+, C_{21}', C_2, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1, 1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \sigma_0, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$	
	$R_4;$	1; 1, 1, -1, 1, 1;		
	$R_5;$	1; 1, -1, -1, 1, 1;		
	$R_6;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$	
	$R_7;$	1; 1, 1, 1, -1, 1;		
	$R_8;$	1; 1, -1, 1, -1, 1;		
	$R_9;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \sigma_0, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$	
	$R_{10};$	1; 1, 1, -1, -1, 1;		
	$R_{11};$	1; 1, -1, -1, -1, 1;		
	$R_{12};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$	
$M; (0\frac{1}{2}0); C_2, C_{21}'', I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; -1, 1, 1, 1;		
	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
$A; (00\frac{1}{2}); \sigma_{d1}, C_3^+, \sigma_h, C_2, \mathcal{T}; \{R_7, R_8\};$		4; $-i\Gamma_{3,1}, \frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,3}, \Gamma_{0,0}, \Gamma_{1,0};$	QDP;	0
	$R_9;$	2; $i\sigma_1, \sigma_0, \sigma_3, \sigma_0, -i\sigma_3;$	P-WNLs;	
	$\{R_{16}, R_{17}\};$	4; $-i\Gamma_{3,1}, \frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,3}, -\Gamma_{0,0}, \Gamma_{1,0};$	QDP;	0
	$R_{18};$	2; $i\sigma_1, \sigma_0, \sigma_3, -\sigma_0, -i\sigma_3;$	P-WNLs;	
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{v1}, I, C_2, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, C_{21}'', I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{KH}$ ;	
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNL $_{KH}$ ;	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); \sigma_{d1}, C_3^+, \sigma_h, I, \mathcal{T};$	$\{R_7, R_8\};$	4; $-i\Gamma_{0,1}, \frac{-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,3}, \Gamma_{1,0};$	DP;	0
	$R_9;$	2; $i\sigma_1, \sigma_0, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Delta; \Gamma A; C_6^+, \sigma_{v1}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	QNL;	0
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	QNL;	0
$U; ML; C_2, \sigma_{v1}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		

$P$ ; KH; $C_3^+, \sigma_{d1}, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0$ ;	WNL; $\pi$
$T$ ; $\Gamma K$ ; $C_{22}'', \sigma_{d2}, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 1; -1, 1, 1;	
	$R_4$ ; 1; -1, -1, 1;	
$S$ ; AH; $C_{22}'', \sigma_h, I\mathcal{T}$ ;	$R_5$ ; 2; $\sigma_2, \sigma_3, -\sigma_0$ ;	WNL; $\pi$
$T'$ ; MK; $C_{21}'', \sigma_{d1}, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 1; -1, 1, 1;	
	$R_4$ ; 1; -1, -1, 1;	
$S'$ ; LH; $C_{21}'', \sigma_h, I\mathcal{T}$ ;	$R_5$ ; 2; $\sigma_2, \sigma_3, -\sigma_0$ ;	WNL; $\pi$
$\Sigma$ ; $\Gamma M$ ; $C_{21}', \sigma_{v1}, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 1; -1, 1, 1;	
	$R_4$ ; 1; -1, -1, 1;	
$R$ ; AL; $C_{21}', \sigma_h, I\mathcal{T}$ ;	$R_5$ ; 2; $\sigma_2, \sigma_3, -\sigma_0$ ;	WNL; $\pi$

$\Gamma_h; \{C_3^+|000\}, \{C_{21}'|000\}, \{C_2|00\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); C_3^+, C_{21}', C_2, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1, 1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \sigma_0, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$	
	$R_4;$	1; 1, 1, -1, 1, 1;		
	$R_5;$	1; 1, -1, -1, 1, 1;		
	$R_6;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$	
	$R_7;$	1; 1, 1, 1, -1, 1;		
	$R_8;$	1; 1, -1, 1, -1, 1;		
	$R_9;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \sigma_0, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$	
	$R_{10};$	1; 1, 1, -1, -1, 1;		
	$R_{11};$	1; 1, -1, -1, -1, 1;		
	$R_{12};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma A}$	
$M; (0\frac{1}{2}0); C_2, C_{21}'', I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; -1, 1, 1, 1;		
	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
$A; (00\frac{1}{2}); C_6^+, C_{21}', I, \mathcal{T};$	$R_{13};$	2; $i\sigma_3, \sigma_1, \sigma_1, -i\sigma_1;$	P-NS $_{ALH};$	
	$R_{14};$	2; $i\sigma_3, \sigma_1, -\sigma_1, -i\sigma_1;$	P-NS $_{ALH};$	
	$R_{15};$	4; $\frac{\sqrt{3}\Gamma_{3,0} + i\Gamma_{0,3}}{2}, \Gamma_{0,1}, \Gamma_{1,1}, -\Gamma_{0,1};$	QDP;	0
$L; (0\frac{1}{2}\frac{1}{2}); C_2, I, \sigma_{d1}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{ALH};$	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{ALH};$	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, C_{21}'', I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0;$	P-WNL $_{KH};$	
	$R_6;$	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0;$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+, C_{21}'', I, \mathcal{T};$	$\{R_1, R_4\};$	2; $\sigma_3, \sigma_3, \sigma_1;$	P-NS $_{ALH};$	
	$\{R_2, R_3\};$	2; $\sigma_3, -\sigma_3, \sigma_1;$	P-NS $_{ALH};$	
	$\{R_5, R_6\};$	4; $\frac{1}{2}(-\Gamma_{3,0} - i\sqrt{3}\Gamma_{3,2}), \Gamma_{3,3}, \Gamma_{1,0};$	DP;	0
$\Delta; \Gamma A; C_6^+, \sigma_{v1}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	QNL;	0
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	QNL;	0
$U; ML; C_2, \sigma_{v1}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		

$P$ ; KH; $C_3^+, \sigma_{d1}, IT$ ; $R_1$ ;	$1; 1, 1, 1;$	
	$R_2$ ;	$1; 1, -1, 1;$
	$R_3$ ;	$2; \frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0; \text{WNL}; \quad \pi$
$T$ ; $\Gamma K$ ; $C_{22}'', \sigma_{d2}, IT$ ; $R_1$ ;	$1; 1, 1, 1;$	
	$R_2$ ;	$1; 1, -1, 1;$
	$R_3$ ;	$1; -1, 1, 1;$
	$R_4$ ;	$1; -1, -1, 1;$
$S$ ; AH; $C_{22}'', \sigma_{d2}, IT$ ; $\{R_2, R_4\}$ ;	$2; \sigma_3, \sigma_0, \sigma_1;$	L-NS <sub>ALH</sub> ;
	$\{R_6, R_8\}$ ;	$2; \sigma_3, -\sigma_0, \sigma_1;$ L-NS <sub>ALH</sub> ;
$T'$ ; MK; $C_{21}'', \sigma_{d1}, IT$ ; $R_1$ ;	$1; 1, 1, 1;$	
	$R_2$ ;	$1; 1, -1, 1;$
	$R_3$ ;	$1; -1, 1, 1;$
	$R_4$ ;	$1; -1, -1, 1;$
$S'$ ; LH; $C_{21}'', \sigma_{d1}, IT$ ; $\{R_2, R_4\}$ ;	$2; \sigma_3, \sigma_0, \sigma_1;$	L-NS <sub>ALH</sub> ;
	$\{R_6, R_8\}$ ;	$2; \sigma_3, -\sigma_0, \sigma_1;$ L-NS <sub>ALH</sub> ;
$\Sigma$ ; $\Gamma M$ ; $C_{21}', \sigma_{v1}, IT$ ; $R_1$ ;	$1; 1, 1, 1;$	
	$R_2$ ;	$1; 1, -1, 1;$
	$R_3$ ;	$1; -1, 1, 1;$
	$R_4$ ;	$1; -1, -1, 1;$
$R$ ; AL; $\sigma_h, C_{21}', IT$ ; $R_5$ ;	$2; \sigma_2, \sigma_3, -\sigma_0;$	L-NS <sub>ALH</sub> ;

$\Gamma_h$ ;  $\{C_3^+|000\}, \{C_{21}'|00\frac{1}{2}\}, \{C_2|00\frac{1}{2}\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; $(000)$ ; $C_3^+, C_{21}', C_2, I, \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1, 1, 1;			
	$R_2$ ; 1; 1, -1, 1, 1, 1;		
	$R_3$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \sigma_0, \sigma_0, -\sigma_0$ ;	P-QNL $_{\Gamma A}$	
	$R_4$ ; 1; 1, 1, -1, 1, 1;		
	$R_5$ ; 1; 1, -1, -1, 1, 1;		
	$R_6$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0, \sigma_0, -\sigma_0$ ;	P-QNL $_{\Gamma A}$	
	$R_7$ ; 1; 1, 1, 1, -1, 1;		
	$R_8$ ; 1; 1, -1, 1, -1, 1;		
	$R_9$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, \sigma_0, -\sigma_0, -\sigma_0$ ;	P-QNL $_{\Gamma A}$	
	$R_{10}$ ; 1; 1, 1, -1, -1, 1;		
	$R_{11}$ ; 1; 1, -1, -1, -1, 1;		
	$R_{12}$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0, -\sigma_0, -\sigma_0$ ;	P-QNL $_{\Gamma A}$	
$M$ ; $(0\frac{1}{2}0)$ ; $C_2, C_{21}'', I, \mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1, 1;		
	$R_2$ ; 1; -1, 1, 1, 1;		
	$R_3$ ; 1; 1, -1, 1, 1;		
	$R_4$ ; 1; -1, -1, 1, 1;		
	$R_5$ ; 1; 1, 1, -1, 1;		
	$R_6$ ; 1; -1, 1, -1, 1;		
	$R_7$ ; 1; 1, -1, -1, 1;		
	$R_8$ ; 1; -1, -1, -1, 1;		
$A$ ; $(00\frac{1}{2})$ ; $C_6^+, C_{21}'', I, \mathcal{T}$ ;	$R_{13}$ ; 2; $i\sigma_3, \sigma_1, \sigma_1, -i\sigma_1$ ;	P-NS $_{ALH}$ ;	
	$R_{14}$ ; 2; $i\sigma_3, \sigma_1, -\sigma_1, -i\sigma_1$ ;	P-NS $_{ALH}$ ;	
	$R_{15}$ ; 4; $\frac{\sqrt{3}\Gamma_{3,0} + i\Gamma_{0,3}}{2}, \Gamma_{0,1}, \Gamma_{1,1}, -\Gamma_{0,1}$ ;	QDP;	0
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_2, I, \sigma_{v1}, \mathcal{T}$ ;	$R_5$ ; 2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-NS $_{ALH}$ ;	
	$R_{10}$ ; 2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-NS $_{ALH}$ ;	
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $S_3^+, C_{21}'', I, \mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;		
	$R_2$ ; 1; 1, -1, 1;		
	$R_3$ ; 1; -1, 1, 1;		
	$R_4$ ; 1; -1, -1, 1;		
	$R_5$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0$ ;	P-WNL $_{KH}$ ;	
	$R_6$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0$ ;	P-WNL $_{KH}$ ;	
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $\sigma_{d1}, C_3^+, \sigma_h, I, \mathcal{T}$ ;	$R_7$ ; 2; $-i\sigma_1, \frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_3, -i\sigma_1$ ;	P-WNL/NS;	
	$R_8$ ; 2; $i\sigma_1, \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_3, -i\sigma_1$ ;	P-WNL/NS;	
	$R_9$ ; 2; $i\sigma_1, \sigma_0, \sigma_3, -i\sigma_1$ ;	P-NS $_{ALH}$ ;	
$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{v1}, I, \mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;		
	$R_2$ ; 1; 1, -1, 1;		
	$R_3$ ; 1; -1, 1, 1;		
	$R_4$ ; 1; -1, -1, 1;		
	$R_5$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0$ ;	QNL;	0
	$R_6$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0$ ;	QNL;	0
$U$ ; ML; $C_2, \sigma_{v1}, I, \mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;		
	$R_2$ ; 1; 1, -1, 1;		
	$R_3$ ; 1; -1, 1, 1;		
	$R_4$ ; 1; -1, -1, 1;		

$P$ ; KH; $C_3^+, \sigma_{d1}, I\mathcal{T}$ ; $R_1$ ;	$1; 1, 1, 1;$	
	$R_2$ ;	$1; 1, -1, 1;$
	$R_3$ ;	$2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0; \text{WNL}; \quad \pi$
$T$ ; $\Gamma\text{K}$ ; $C_{22}'', \sigma_{d2}, I\mathcal{T}$ ; $R_1$ ;	$1; 1, 1, 1;$	
	$R_2$ ;	$1; 1, -1, 1;$
	$R_3$ ;	$1; -1, 1, 1;$
	$R_4$ ;	$1; -1, -1, 1;$
$S$ ; AH; $\sigma_h, C_{22}'', I\mathcal{T}$ ; $R_5$ ;	$2; \sigma_2, \sigma_3, -\sigma_0;$	L-NS <sub>ALH</sub> ;
$T'$ ; MK; $C_{21}'', \sigma_{d1}, I\mathcal{T}$ ; $R_1$ ;	$1; 1, 1, 1;$	
	$R_2$ ;	$1; 1, -1, 1;$
	$R_3$ ;	$1; -1, 1, 1;$
	$R_4$ ;	$1; -1, -1, 1;$
$S'$ ; LH; $\sigma_h, C_{21}'', I\mathcal{T}$ ; $R_5$ ;	$2; \sigma_2, \sigma_3, -\sigma_0;$	L-NS <sub>ALH</sub> ;
$\Sigma$ ; $\Gamma\text{M}$ ; $C_{21}', \sigma_{v1}, I\mathcal{T}$ ; $R_1$ ;	$1; 1, 1, 1;$	
	$R_2$ ;	$1; 1, -1, 1;$
	$R_3$ ;	$1; -1, 1, 1;$
	$R_4$ ;	$1; -1, -1, 1;$
$R$ ; AL; $\sigma_h, \sigma_{v1}, I\mathcal{T}$ ; $\{R_2, R_4\}$ ; $2; \sigma_3, \sigma_0, \sigma_1$ ;		L-NS <sub>ALH</sub> ;
	$\{R_6, R_8\}$ ; $2; \sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>ALH</sub> ;

SG 195

 $\Gamma_c; \{C_{31}^+|000\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	C-4 WP; 4
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T};$	$R_4;$	3; $A_9, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
$M; (\frac{1}{2}\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T};$	$R_4;$	1; -1, -1, 1;	
	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_4;$	1; -1, -1, 1;	
	$R_1;$	1; 1, 1, 1, 1;	
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	C-4 WP; 4
	$R_4;$	3; $A_9, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2x};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$\Sigma; \Gamma M; E, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
$\Lambda; \Gamma R; C_{31}^+;$	$R_1;$	1; 1;	
	$R_2;$	1; $(-1)^{2/3};$	
	$R_3;$	1; $-\sqrt[3]{-1};$	
$S; XR; E, \mathcal{T}C_{2y};$	$R_1;$	1; 1, 1;	
$Z; XM; C_{2x}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$T; MR; C_{2z}, \mathcal{T}C_{2x};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	

SG 196

 $\Gamma_c^f$ ;  $\{C_{31}^+|000\}$ ,  $\{C_{2z}|000\}$ ,  $\{C_{2y}|000\}$ ,  $\mathcal{T}$ ; Non-Centrosymmetric; without SOC

$\Gamma$ ; (000); $C_{31}^+, C_{2z}, C_{2y}, \mathcal{T}$ ; $R_1$ ;	1; 1, 1, 1, 1;	
	$\{R_2, R_3\}$ ; 2; $\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1$ ;	C-4 WP; 4
	$R_4$ ; 3; $A_9, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	C-2 TP; 2
$X$ ; $(\frac{1}{2}0\frac{1}{2})$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;
	$R_2$ ;	1; 1, -1, 1;
	$R_3$ ;	1; -1, 1, 1;
	$R_4$ ;	1; -1, -1, 1;
$L$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $C_{31}^+, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1;
	$\{R_2, R_3\}$ ; 2; $\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_1$ ;	C-2 WP; 2
$W$ ; $(\frac{1}{2}\frac{1}{4}\frac{3}{4})$ ; $C_{2x}, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;
	$R_2$ ;	1; -1, 1;
$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2x}$ ;	$R_1$ ;	1; 1, 1;
	$R_2$ ;	1; -1, 1;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+$ ;	$R_1$ ;	1; 1;
	$R_2$ ;	1; $(-1)^{2/3}$ ;
	$R_3$ ;	1; $-\sqrt[3]{-1}$ ;
$\Sigma$ ; $\Gamma\Sigma$ ; $E, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;
$S$ ; $XS$ ; $E, \mathcal{T}C_{2y}$ ;	$R_1$ ;	1; 1, 1;
$Z$ ; $XW$ ; $C_{2x}, \mathcal{T}C_{2z}$ ;	$R_1$ ;	1; 1, 1;
	$R_2$ ;	1; -1, 1;
$Q$ ; $LW$ ; $E$ ;	$R_1$ ;	1; 1;



$\Gamma_c^v$ ;  $\{C_{31}^+|000\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$\Gamma$ ; (000); $C_{31}^+, C_{2z}, C_{2y}, \mathcal{T}$ ; $R_1$ ;	$1; 1, 1, 1, 1;$	
	$\{R_2, R_3\}; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	C-4 WP; 4
	$R_4; 3; A_9, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$H$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $C_{31}^+, C_{2z}, C_{2y}, \mathcal{T}$ ; $R_1$ ;	$1; 1, 1, 1, 1;$	
	$\{R_2, R_3\}; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	C-4 WP; 4
	$R_4; 3; A_9, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$P$ ; $(\frac{1}{4}\frac{1}{4}\frac{1}{4})$ ; $C_{31}^+, C_{2z}, C_{2y}$ ; $R_1$ ;	$1; 1, 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1, 1;$	
	$R_4; 3; A_9, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{10};$	C-2 TP; 2
$N$ ; $(00\frac{1}{2})$ ; $C_{2z}, \mathcal{T}$ ; $R_1$ ;	$1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$\Sigma$ ; $\Gamma N$ ; $E, \mathcal{T}C_{2z}$ ; $R_1$ ;	$1; 1, 1;$	
$\Delta$ ; $\Gamma H$ ; $C_{2y}, \mathcal{T}C_{2x}$ ; $R_1$ ;	$1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$\Lambda$ ; $\Gamma P$ ; $C_{31}^+$ ; $R_1$ ;	$1; 1;$	
	$R_2; 1; (-1)^{2/3};$	
	$R_3; 1; -\sqrt[3]{-1};$	
$D$ ; $NP$ ; $C_{2z}$ ; $R_1$ ;	$1; 1;$	
	$R_2; 1; -1;$	
$G$ ; $HN$ ; $E, \mathcal{T}C_{2z}$ ; $R_1$ ;	$1; 1, 1;$	
$F$ ; $PH$ ; $C_{34}^+$ ; $R_1$ ;	$1; 1;$	
	$R_2; 1; (-1)^{2/3};$	
	$R_3; 1; -\sqrt[3]{-1};$	

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 $\Gamma_c; \{C_{31}^+|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 


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$\Gamma; (000);$	$C_{31}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
		$\{R_2, R_3\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	C-4 WP;	4
		$R_4;$	3; $A_9, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP;	2
$X; (0\frac{1}{2}0);$	$C_{2y}, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-NS <sub>XMR</sub> ;	
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{2y}, C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_0, \sigma_1;$	P-NSs;	
		$\{R_6, R_8\};$	2; $i\sigma_3, -\sigma_0, \sigma_1;$	P-NSs;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{31}^-, C_{2x}, C_{2y}, \mathcal{T};$	$\{R_4, R_4\};$	4; $\Gamma_{27}, -i\Gamma_{0,1}, i\Gamma_{0,2}, -\Gamma_{2,2};$	C-2 DP;	2
		$\{R_5, R_6\};$	4; $\Gamma_{11}, -i\Gamma_{3,1}, i\Gamma_{0,2}, \Gamma_{1,0};$	C-2 DP;	2
$\Delta; \Gamma X;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$\Sigma; \Gamma M;$	$E, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
$\Lambda; \Gamma R;$	$C_{31}^+;$	$R_1;$	1; 1;		
		$R_2;$	1; $(-1)^{2/3};$		
		$R_3;$	1; $-\sqrt[3]{-1};$		
$S; XR;$	$E, \mathcal{T}C_{2y};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	L-NS <sub>XMR</sub> ;	
$Z; XM;$	$C_{2x}, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>XMR</sub> ;	
$T; MR;$	$C_{2z}, \mathcal{T}C_{2x};$	$\{R_2, R_2\};$	2; $\sigma_0, -i\sigma_2;$	L-NS <sub>XMR</sub> ;	
		$\{R_4, R_4\};$	2; $-\sigma_0, -i\sigma_2;$	L-NS <sub>XMR</sub> ;	

$\Gamma_c^v; \{C_{31}^+|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	C-4 WP; 4
	$R_4;$	3; $A_9, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^-, C_{2x}, C_{2y}, \mathcal{T};$	$R_4;$	1; -1, -1, -1, 1;	
	$\{R_5, R_6\};$	2; $\frac{\sigma_0-i\sqrt{3}\sigma_3}{2}, -\sigma_0, -\sigma_0, \sigma_1;$	C-4 WP; 4
	$R_8;$	3; $-A_9, -A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{31}^+, C_{2x}, C_{2z};$	$R_7;$	2; $\frac{\sqrt{3}\sigma_3+i\sigma_0}{2}, \sigma_{21}, \sigma_{22};$	C-1 WP; 1
	$R_8;$	2; $\sigma_{16}, \sigma_{21}, \sigma_{22};$	C-1 WP; 1
	$R_9;$	2; $\sigma_{19}, \sigma_{21}, \sigma_{22};$	C-1 WP; 1
$N; (00\frac{1}{2}); C_{2z}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$\Sigma; \Gamma N; E, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
$\Delta; \Gamma H; C_{2y}, \mathcal{T}C_{2x};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$A; \Gamma P; C_{31}^+;$	$R_1;$	1; 1;	
	$R_2;$	1; $(-1)^{2/3};$	
	$R_3;$	1; $-\sqrt[3]{-1};$	
$D; NP; C_{2z};$	$R_2;$	1; 1;	
	$R_4;$	1; -1;	
$G; HN; E, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;	
$F; PH; C_{34}^+;$	$R_2;$	1; $-(-1)^{5/6};$	
	$R_4;$	1; $i;$	
	$R_6;$	1; $-\sqrt[6]{-1};$	

$\Gamma_c; \{S_{61}^+|000\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_{61}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma R};$	
	$R_4;$	3; $A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$R_5;$	1; -1, 1, 1, 1;		
	$\{R_6, R_7\};$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma R};$	
	$R_8;$	3; $-A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; -1, 1, 1, 1;		
	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
$M; (\frac{1}{2}\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; -1, 1, 1, 1;		
	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{61}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma R};$	
	$R_4;$	3; $A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$R_5;$	1; -1, 1, 1, 1;		
	$\{R_6, R_7\};$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma R};$	
	$R_8;$	3; $-A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Sigma; \Gamma M; \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Lambda; \Gamma R; C_{31}^+, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	WNL;	$\pi$
$S; X R; \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$Z; X M; C_{2x}, \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$T; M R; C_{2z}, \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		

SG 201

 $\Gamma_c; \{S_{61}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2z} | 000\}, \{C_{2y} | 000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_{61}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma R};$	
	$R_4;$	3; $A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$R_5;$	1; -1, 1, 1, 1;		
$X; (0\frac{1}{2}0); \sigma_z, \sigma_y, C_{2y}, \mathcal{T};$	$\{R_6, R_7\};$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma R};$	
	$R_8;$	3; $-A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$M; (\frac{1}{2}\frac{1}{2}0); \sigma_x, \sigma_z, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{61}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma R};$	
	$R_4;$	3; $A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$R_5;$	1; -1, 1, 1, 1;		
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$\{R_6, R_7\};$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma R};$	
	$R_8;$	3; $-A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
$\Sigma; \Gamma M; \sigma_z, I\mathcal{T};$	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Lambda; \Gamma R; C_{31}^+, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	WNL;	$\pi$
$S; X R; \sigma_y, I\mathcal{T};$	$R_2;$	1; 1, 1;		
	$R_4;$	1; -1, 1;		
$Z; X M; \sigma_y, C_{2x}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
	$R_2;$	1; $-i, 1, 1;$		
$T; M R; \sigma_y, C_{2z}, I\mathcal{T};$	$R_4;$	1; $i, 1, 1;$		
	$R_6;$	1; $-i, -1, 1;$		
	$R_8;$	1; $i, -1, 1;$		

$\Gamma_c^f; \{S_{61}^+|000\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_{61}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma L}$ ;	
	$R_4;$	3; $A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$R_5;$	1; -1, 1, 1, 1;		
	$\{R_6, R_7\};$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma L}$ ;	
	$R_8;$	3; $-A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$X; (\frac{1}{2}0\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;	
	$R_2;$	1; -1, 1, 1, 1;		
$L; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{61}^+, \mathcal{T};$	$R_3;$	1; 1, -1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	1; 1, 1, -1, 1;		
	$R_6;$	1; -1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, -1, -1, 1;		
	$R_1;$	1; 1, 1;		
	$\{R_2, R_6\};$	2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	P-WNL $_{\Gamma L}$ ;	
$W; (\frac{1}{2}\frac{1}{4}\frac{3}{4}); C_{2x}, \sigma_z, I\mathcal{T};$	$\{R_3, R_5\};$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	P-WNL $_{\Gamma L}$ ;	
	$R_4;$	1; -1, 1;		
	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_1;$	1; 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	WNL;	$\pi$
	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Lambda; \Gamma L; C_{31}^+, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$\Sigma; \Gamma \Sigma; \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1;	
	$S; X S; \sigma_y, I\mathcal{T};$	$R_1;$	1; 1, 1;	
	$Z; X W; C_{2x}, \sigma_z, I\mathcal{T};$	$R_2;$	1; -1, 1;	
	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$Q; L W; E, I\mathcal{T};$	$R_1;$	1; 1, 1;		

$\Gamma_c^f; \{S_{61}^+ | \frac{1}{4} \frac{1}{4} \frac{1}{4}\}, \{C_{2z} | 000\}, \{C_{2y} | 000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_{61}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma L}$ ;	
	$R_4;$	3; $A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$R_5;$	1; -1, 1, 1, 1;		
	$\{R_6, R_7\};$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma L}$ ;	
	$R_8;$	3; $-A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
$X; (\frac{1}{2} 0 \frac{1}{2}); \sigma_z, \sigma_y, C_{2y}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
$L; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); S_{61}^+, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$\{R_2, R_6\};$	2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	P-WNL $_{\Gamma L}$ ;	
	$\{R_3, R_5\};$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	P-WNL $_{\Gamma L}$ ;	
	$R_4;$	1; -1, 1;		
$W; (\frac{1}{2} \frac{1}{4} \frac{3}{4}); \sigma_z, C_{2x}, I\mathcal{T};$	$R_9;$	2; $\sqrt[4]{-1}\sigma_3, \sigma_2, -\sigma_0;$	P-WNL $_{XW}$ ;	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Lambda; \Gamma L; C_{31}^+, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma \Sigma; \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; X S; \sigma_y, I\mathcal{T};$	$R_2;$	1; 1, 1;		
	$R_4;$	1; -1, 1;		
$Z; X W; \sigma_y, C_{2x}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$
$Q; L W; E, I\mathcal{T};$	$R_1;$	1; 1, 1;		

$\Gamma_c^v; \{S_{61}^+|000\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma; (000); S_{61}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;			
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma P}$ ;		
	$R_4;$	3; $A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0	
	$R_5;$	1; -1, 1, 1, 1;			
	$\{R_6, R_7\};$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma P}$ ;		
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{61}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_8;$	3; $-A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0	
	$R_1;$	1; 1, 1, 1, 1;			
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{PH}$ ;		
	$R_4;$	3; $A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0	
	$R_5;$	1; -1, 1, 1, 1;			
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{31}^+, C_{2z}, C_{2y}, I\mathcal{T};$	$\{R_6, R_7\};$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{PH}$ ;		
	$R_8;$	3; $-A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0	
	$R_1;$	1; 1, 1, 1, 1;			
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma P/PH}$ ;		
	$R_4;$	3; $A_9, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	TP ;	0	
$N; (00\frac{1}{2}); C_{2z}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;			
	$R_2;$	1; 1, -1, 1;			
	$R_3;$	1; -1, 1, 1;			
	$R_4;$	1; -1, -1, 1;			
	$R_1;$	1; 1, 1;			
$\Sigma; \Gamma N; \sigma_z, I\mathcal{T};$	$R_2;$	1; -1, 1;			
	$\Delta; \Gamma H; C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;			
	$R_3;$	1; -1, 1, 1;			
	$R_4;$	1; -1, -1, 1;			
$\Lambda; \Gamma P; C_{31}^+, I\mathcal{T};$	$R_1;$	1; 1, 1;			
	$\{R_2, R_3\};$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	WNL;	$\pi$	
	$D; \Gamma N; C_{2z}, I\mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;			
	$G; \Gamma H; \sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1;		
$F; \Gamma H; C_{34}^+, I\mathcal{T};$	$R_2;$	1; -1, 1;			
	$R_1;$	1; 1, 1;			
	$\{R_2, R_3\};$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	WNL;	$\pi$	



$\Gamma_c; \{S_{61}^+|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma; (000);$	$S_{61}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
		$\{R_2, R_3\};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma R}$ ;	
		$R_4;$	3; $A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
		$R_5;$	1; -1, 1, 1, 1;		
		$\{R_6, R_7\};$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma R}$ ;	
		$R_8;$	3; $-A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
$X; (0\frac{1}{2}0);$	$C_{2y}, C_{2z}, \sigma_z, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-NS $_{XMR}$ ;	
		$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-NS $_{XMR}$ ;	
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{2x}, C_{2z}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	4; $i\Gamma_{3,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	P-DNL $_{MR}$ ;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{31}^-, C_{2x}, C_{2y}, I, \mathcal{T};$	$\{R_4, R_4\};$	4; $\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,3}}{2}, \Gamma_{28}, \Gamma_{29}, \Gamma_{0,0}, -\Gamma_{2,2};$	P-DNL $_{MR}$ ;	
		$\{R_5, R_6\};$	4; $\Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, \Gamma_{1,0};$	P-DNL $_{MR}$ ;	
		$\{R_{11}, R_{11}\};$	4; $\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,3}}{2}, \Gamma_{28}, \Gamma_{29}, -\Gamma_{0,0}, -\Gamma_{2,2};$	P-DNL $_{MR}$ ;	
		$\{R_{12}, R_{13}\};$	4; $\Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, \Gamma_{1,0};$	P-DNL $_{MR}$ ;	
$\Delta; \Gamma X;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
$\Sigma; \Gamma M;$	$\sigma_z, I\mathcal{T};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$\Lambda; \Gamma R;$	$C_{31}^+, I\mathcal{T};$	$R_1;$	1; 1, 1;		
		$\{R_2, R_3\};$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	WNL;	$\pi$
$S; XR;$	$\sigma_y, I\mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	L-NS $_{XMR}$ ;	
$Z; XM;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_0, \sigma_1;$	L-NS $_{XMR}$ ;	
		$\{R_6, R_8\};$	2; $\sigma_3, -\sigma_0, \sigma_1;$	L-NS $_{XMR}$ ;	
$T; MR;$	$C_{2z}, \sigma_x, I\mathcal{T};$	$\{R_5, R_5\};$	4; $\Gamma_{0,2}, -i\Gamma_{0,1}, -\Gamma_{2,2};$	DNL;	0
$Z'^a; X'M(\frac{1}{2}\alpha 0);$	$\sigma_x, C_{2z}, I\mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -\sigma_0;$	L-NS $_{X'MR}$ ;	

<sup>a</sup>For the notation, see Table 5.11, Fig. 5.4 and the text of section 5.5 in Ref. [9].

$\Gamma_c^v; \{S_{61}^+|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_{61}^+, C_{2z}, C_{2y}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma P};$	
	$R_4;$	3; $A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$R_5;$	1; -1, 1, 1, 1;		
	$\{R_6, R_7\};$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{\Gamma P};$	
	$R_8;$	3; $-A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{10}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^-, C_{2x}, C_{2y}, I, \mathcal{T};$	$R_4;$	1; -1, -1, -1, 1, 1;	
	$\{R_5, R_6\};$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, -\sigma_0, -\sigma_0, \sigma_0, \sigma_1;$	P-WNL $_{HP};$	
	$R_8;$	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_0, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$R_{12};$	1; -1, -1, -1, -1, 1;		
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{31}^+, C_{2x}, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, -\sigma_0, -\sigma_0, -\sigma_0, \sigma_1;$	P-WNL $_{HP};$	
	$R_{16};$	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_0, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	0
	$\{R_7, R_7\};$	4; $\frac{\sqrt{3}\Gamma_{0,3} + i\Gamma_{0,0}}{2}, \Gamma_{30}, \Gamma_{31}, -\Gamma_{2,2};$	DP;	0
	$\{R_8, R_9\};$	4; $i\Gamma_8, \Gamma_{32}, \Gamma_{33}, \Gamma_{1,0};$	DP;	0
	$N; (00\frac{1}{2}); \sigma_z, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNL $_{NP};$
	$\Sigma; \Gamma N; \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1;	
		$R_2;$	1; -1, 1;	
	$\Delta; \Gamma H; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
$\Lambda; \Gamma P; C_{31}^+, I, \mathcal{T};$	$R_4;$	1; -1, -1, 1;		
	$R_1;$	1; 1, 1;		
	$\{R_2, R_3\};$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_1;$	WNL;	$\pi$
	$D; NP; C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	2; $\sigma_3, \sigma_1;$	WNL;
	$G; HN; \sigma_z, I, \mathcal{T};$	$R_1;$	1; -i, 1;	$\pi$
		$R_2;$	1; i, 1;	
	$F; PH; C_{34}^+, I, \mathcal{T};$	$\{R_2, R_6\};$	2; $\frac{1}{2}(\sqrt{3}\sigma_3 - i\sigma_0), \sigma_1;$	WNL;
		$R_4;$	1; i, 1;	$\pi$

$\Gamma_c; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{C_{2a}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
		$R_2; 1; 1, 1, 1, -1, 1;$	
		$R_3; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	C-4 WP; 4
		$R_4; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
		$R_5; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$X; (0\frac{1}{2}0);$	$C_{4y}^+, C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
		$R_2; 1; 1, -1, 1;$	
		$R_3; 1; -1, 1, 1;$	
		$R_4; 1; -1, -1, 1;$	
		$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+, C_{2x}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
		$R_2; 1; 1, -1, 1;$	
		$R_3; 1; -1, 1, 1;$	
		$R_4; 1; -1, -1, 1;$	
		$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
		$R_2; 1; 1, 1, 1, -1, 1;$	
		$R_3; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	C-4 WP; 4
		$R_4; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
		$R_5; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$\Delta; \Gamma X;$	$C_{4y}^+, C_{2c} \mathcal{T};$	$R_1; 1; 1, 1;$	
		$R_2; 1; i, 1;$	
		$R_3; 1; -1, 1;$	
		$R_4; 1; -i, 1;$	
$\Sigma; \Gamma M;$	$C_{2a}, C_{2b} \mathcal{T};$	$R_1; 1; 1, 1;$	
		$R_2; 1; -1, 1;$	
$\Lambda; \Gamma R;$	$C_{31}^+, C_{2e} \mathcal{T};$	$R_1; 1; 1, 1;$	
		$R_2; 1; (-1)^{2/3}, 1;$	
		$R_3; 1; -\sqrt[3]{-1}, 1;$	
$S; X R;$	$C_{2c}, C_{2e} \mathcal{T};$	$R_1; 1; 1, 1;$	
		$R_2; 1; -1, 1;$	
$Z; X M;$	$C_{2x}, \mathcal{T} C_{2y};$	$R_1; 1; 1, 1;$	
		$R_2; 1; -1, 1;$	
$T; M R;$	$C_{4z}^+, \mathcal{T} C_{2y};$	$R_1; 1; 1, 1;$	
		$R_2; 1; i, 1;$	
		$R_3; 1; -1, 1;$	
		$R_4; 1; -i, 1;$	

$\Gamma_c; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
		$R_2; 1; 1, 1, 1, -1, 1;$	
		$R_3; 2; \frac{-\sigma_0+i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	C-4 WP; 4
		$R_4; 3; A_{11}, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
		$R_5; 3; A_{11}, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$X; (0\frac{1}{2}0);$	$C_{4y}^+, C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
		$R_2; 1; 1, -1, 1;$	
		$R_3; 1; -1, 1, 1;$	
		$R_4; 1; -1, -1, 1;$	
		$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+, C_{2x}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
		$R_2; 1; 1, -1, 1;$	
		$R_3; 1; -1, 1, 1;$	
		$R_4; 1; -1, -1, 1;$	
		$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
		$R_2; 1; 1, 1, 1, -1, 1;$	
		$R_3; 2; \frac{-\sigma_0+i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	C-4 WP; 4
		$R_4; 3; A_{11}, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
		$R_5; 3; A_{11}, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$\Delta; \Gamma X;$	$C_{4y}^+, C_{2c} \mathcal{T};$	$R_1; 1; 1, 1;$	
		$R_2; 1; i, 1;$	
		$R_3; 1; -1, 1;$	
		$R_4; 1; -i, 1;$	
$\Sigma; \Gamma M;$	$C_{2a}, C_{2b} \mathcal{T};$	$R_1; 1; 1, 1;$	
		$R_2; 1; -1, 1;$	
$\Lambda; \Gamma R;$	$C_{31}^+, C_{2e} \mathcal{T};$	$R_1; 1; 1, 1;$	
		$R_2; 1; (-1)^{2/3}, 1;$	
		$R_3; 1; -\sqrt[3]{-1}, 1;$	
$S; X R;$	$C_{2c}, C_{2e} \mathcal{T};$	$R_2; 1; 1, 1;$	
		$R_4; 1; -1, 1;$	
$Z; X M;$	$C_{2x}, \mathcal{T} C_{2y};$	$R_1; 1; 1, 1;$	
		$R_2; 1; -1, 1;$	
$T; M R;$	$C_{4z}^+, E, \mathcal{T} C_{2y};$	$R_5; 1; -1, 1, 1;$	
		$R_6; 1; -i, 1, 1;$	
		$R_7; 1; 1, 1, 1;$	
		$R_8; 1; i, 1, 1;$	

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 $\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{C_{2a}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;	
	$R_2;$	1; 1, 1, 1, -1, 1;	
	$R_3;$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	C-4 WP; 4
	$R_4;$	3; $A_{11}, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
	$R_5;$	3; $A_{11}, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$X; (\frac{1}{2}0\frac{1}{2}); C_{4y}^+, C_{2z}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	1; -1, 1, 1;	
	$R_4;$	1; -1, -1, 1;	
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$L; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^+, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$R_3;$	2; $\frac{-\sigma_0-i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$W; (\frac{1}{2}\frac{1}{4}\frac{3}{4}); C_{2x}, C_{2d}, C_{4x}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;	
	$R_2;$	1; 1, -1, 1;	
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	C-2 WP; 2
$\Delta; \Gamma X; C_{4y}^+, C_{2c}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $i, 1;$	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; $-i, 1;$	
$\Lambda; \Gamma L; C_{31}^+, C_{2e}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $(-1)^{2/3}, 1;$	
	$R_3;$	1; $-\sqrt[3]{-1}, 1;$	
$\Sigma; \Gamma \Sigma; C_{2a}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$S; X S; C_{2c}, C_{2e}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$Z; X W; C_{2x}, \mathcal{T} C_{2y};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$Q; L W; C_{2f};$	$R_1;$	1; 1;	
	$R_2;$	1; -1;	

SG 210

 $\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{C_{2a}|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
	$R_2; 1; 1, 1, 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	C-4 WP; 4
	$R_4; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
	$R_5; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$X; (\frac{1}{2}0\frac{1}{2}); C_{4y}^-, C_{2z}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	C-2 WP; 2
$L; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^+, C_{2b}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	C-2 WP; 2
$W; (\frac{1}{2}\frac{1}{4}\frac{3}{4}); E, C_{2x}, C_{2f}, C_{4x}^+ \mathcal{T};$	$R_{10}; 2; -i\sigma_0, \sigma_1, \sigma_3, \frac{i(\sigma_2 - \sigma_3)}{\sqrt{2}};$	C-1 WP; 1
$\Delta; \Gamma X; C_{4y}^+, C_{2c} \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; i, 1;$	
	$R_3; 1; -1, 1;$	
	$R_4; 1; -i, 1;$	
$\Lambda; \Gamma L; C_{31}^+, C_{2e} \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1;$	
$\Sigma; \Gamma \Sigma; C_{2a}, C_{2b} \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$S; X S; C_{2c}, C_{2e} \mathcal{T};$	$R_2; 1; 1, 1;$	
	$R_4; 1; -1, 1;$	
$Z; X W; C_{2x}, \mathcal{T} C_{2y};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$Q; L W; C_{2f};$	$R_4; 1; 1;$	
	$R_8; 1; -1;$	

SG 211

 $\Gamma_c^0; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{C_{2a}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
	$R_2; 1; 1, 1, 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	C-4 WP; 4
	$R_4; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
	$R_5; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
	$R_2; 1; 1, 1, 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	C-4 WP; 4
	$R_4; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
	$R_5; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{31}^+, C_{2z}, C_{2y}, C_{2c}\mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1, 1, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1, 1, 1;$	
	$R_4; 3; A_9, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{10}, A_{15};$	C-2 TP; 2
$N; (00\frac{1}{2}); C_{2z}, C_{2b}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$\Sigma; \Gamma N; C_{2a}, C_{2b}\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; -1, 1, 1;$	
$\Delta; \Gamma H; C_{4y}^+, C_{2c}\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; i, 1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -i, 1, 1;$	
$\Lambda; \Gamma P; C_{31}^+, C_{2e}\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1, 1;$	
$D; \Gamma P; C_{2z}, C_{2b}\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; -1, 1, 1;$	
$G; \Gamma H; C_{2b}, \mathcal{T}C_{2z};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; -1, 1, 1;$	
$F; \Gamma H; C_{34}^+, C_{2e}\mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1, 1;$	

$\Gamma_c; \{C_{31}^-|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{C_{2a}|\frac{1}{4}\frac{3}{4}\frac{3}{4}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1, 1;		
	$R_3;$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	C-4 WP;	4
	$R_4;$	3; $A_{11}, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP;	2
	$R_5;$	3; $A_{11}, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP;	2
$X; (0\frac{1}{2}0); C_{4y}^-, C_{2x}, \mathcal{T};$	$R_6;$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>XMR</sub> ;	
	$R_7;$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>XMR</sub> ;	
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^-, C_{2z}, C_{2a}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;	
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;	
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-NSs;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2x}, C_{2y}, C_{31}^-, C_{2b}, \mathcal{T};$	$\{R_4, R_5\};$	4; $\Gamma_{34}, \Gamma_{35}, \frac{-\Gamma_{0,0}+i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,1}, \Gamma_{1,0};$	C-2 DP;	2
	$R_8;$	4; $-\frac{i(\Gamma_{0,2}+\Gamma_{3,3})}{\sqrt{2}}, -\frac{i(\Gamma_{0,2}-\Gamma_{3,3})}{\sqrt{2}}, \Gamma_1, \Gamma_{0,3}, -\Gamma_{1,0};$	C-2 DP;	2
$\Delta; \Gamma X; C_{4y}^+, C_{2c}, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; $i, 1;$		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; $-i, 1;$		
$\Sigma; \Gamma M; C_{2a}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Lambda; \Gamma R; C_{31}^+, C_{2e}, \mathcal{T};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; $(-1)^{2/3}, 1;$		
	$R_3;$	1; $-\sqrt[3]{-1}, 1;$		
$S; XR; C_{2c}, C_{2e}, \mathcal{T};$	$\{R_4, R_8\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>XMR</sub> ;	
$Z; XM; C_{2x}, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>XMR</sub> ;	
$T; MR; C_{4z}^+, E, \mathcal{T}C_{2y};$	$\{R_5, R_7\};$	2; $-\sigma_3, \sigma_0, -i\sigma_2;$	L-NSs;	
	$\{R_6, R_8\};$	2; $-i\sigma_3, \sigma_0, -i\sigma_2;$	L-NSs;	



SG 213

 $\Gamma_c; \{C_{31}^-|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{C_{2a}|\frac{3}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;	
	$R_2;$	1; 1, 1, 1, -1, 1;	
	$R_3;$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	C-4 WP; 4
	$R_4;$	3; $A_{11}, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
	$R_5;$	3; $A_{11}, -\frac{A_0+2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$X; (0\frac{1}{2}0); C_{4y}^-, C_{2x}, \mathcal{T};$	$R_6;$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>XMR</sub> ;
	$R_7;$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, \sigma_3, -\sigma_0;$	P-NS <sub>XMR</sub> ;
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^-, C_{2z}, C_{2a}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-NSs;
	$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-NSs;
	$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-NSs;
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2x}, C_{2y}, C_{31}^-, C_{2b}, \mathcal{T};$	$\{R_4, R_5\};$	4; $\Gamma_{34}, \Gamma_{35}, \frac{-\Gamma_{0,0}+i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,1}, \Gamma_{1,0};$	C-2 DP; 2
	$R_8;$	4; $-\frac{i(\Gamma_{0,2}+\Gamma_{3,3})}{\sqrt{2}}, -\frac{i(\Gamma_{0,2}-\Gamma_{3,3})}{\sqrt{2}}, \Gamma_1, \Gamma_{0,3}, -\Gamma_{1,0};$	C-2 DP; 2
$\Delta; \Gamma X; C_{4y}^+, C_{2c}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $i, 1;$	
	$R_3;$	1; -1, 1;	
	$R_4;$	1; $-i, 1;$	
$\Sigma; \Gamma M; C_{2a}, C_{2b}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; -1, 1;	
$\Lambda; \Gamma R; C_{31}^+, C_{2e}, \mathcal{T};$	$R_1;$	1; 1, 1;	
	$R_2;$	1; $(-1)^{2/3}, 1;$	
	$R_3;$	1; $-\sqrt[3]{-1}, 1;$	
$S; XR; C_{2c}, C_{2e}, \mathcal{T};$	$\{R_2, R_6\};$	2; $\sigma_3, \sigma_1;$	L-NS <sub>XMR</sub> ;
$Z; XM; C_{2x}, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	2; $\sigma_3, -i\sigma_2;$	L-NS <sub>XMR</sub> ;
$T; MR; C_{4z}^+, E, \mathcal{T}C_{2y};$	$\{R_5, R_7\};$	2; $-\sigma_3, \sigma_0, -i\sigma_2;$	L-NSs;
	$\{R_6, R_8\};$	2; $-i\sigma_3, \sigma_0, -i\sigma_2;$	L-NSs;

SG 214

 $\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{C_{2a}|\frac{1}{2}00\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^-, C_{2z}, C_{2x}, C_{2a}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
	$R_2; 1; 1, 1, 1, -1, 1;$	
	$R_3; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	C-4 WP; 4
	$R_4; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
	$R_5; 3; A_{11}, -\frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{32}^-, C_{2x}, C_{2y}, C_{2a}, \mathcal{T};$	$R_3; 1; -1, -1, -1, -1, 1;$	
	$R_4; 1; -1, -1, -1, 1, 1;$	
	$R_6; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	C-4 WP; 4
	$R_9; 3; -A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
	$R_{10}; 3; -A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	C-2 TP; 2
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{31}^+, C_{2x}, C_{2z}, C_{2c}, \mathcal{T};$	$R_7; 2; \frac{\sqrt{3}\sigma_3 + i\sigma_0}{2}, \sigma_{21}, \sigma_{22}, \sigma_{23};$	C-1 WP; 1
	$R_8; 2; \sigma_{16}, \sigma_{21}, \sigma_{22}, \sigma_{23};$	C-1 WP; 1
	$R_9; 2; \sigma_{19}, \sigma_{21}, \sigma_{22}, \sigma_{23};$	C-1 WP; 1
$N; (00\frac{1}{2}); C_{2a}, C_{2b}, \mathcal{T};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; 1, -1, 1;$	
	$R_3; 1; -1, 1, 1;$	
	$R_4; 1; -1, -1, 1;$	
$\Sigma; \Gamma N; C_{2a}, C_{2b}, \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; -1, 1;$	
$\Delta; \Gamma H; C_{4y}^+, C_{2c}, \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; i, 1;$	
	$R_3; 1; -1, 1;$	
	$R_4; 1; -i, 1;$	
$\Lambda; \Gamma P; C_{31}^+, C_{2e}, \mathcal{T};$	$R_1; 1; 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1;$	
$D; \Gamma P; C_{2z}, C_{2b}, \mathcal{T};$	$R_2; 1; 1, 1;$	
	$R_4; 1; -1, 1;$	
$G; \Gamma H; C_{2b}, \mathcal{T} C_{2z};$	$R_2; 1; 1, 1;$	
	$R_4; 1; -1, 1;$	
$F; \Gamma H; C_{34}^+, C_{2e}, \mathcal{T};$	$R_2; 1; -(-1)^{5/6}, 1;$	
	$R_4; 1; i, 1;$	
	$R_6; 1; -\sqrt[6]{-1}, 1;$	

$\Gamma_c; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{\sigma_{da}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^-, C_{2z}, C_{2x}, \sigma_{da}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1, 1;		
	$R_3;$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	P-WNLs	
	$R_4;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_5;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
$X; (0\frac{1}{2}0); S_{4y}^+, C_{2z}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma X};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{MR};$	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^-, C_{2z}, C_{2x}, \sigma_{da}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1, 1;		
	$R_3;$	2; $\frac{-\sigma_0+i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	P-WNLs	
	$R_4;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_5;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
$\Delta; \Gamma X; C_{2y}, \sigma_{dc}, S_{4y}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$\Lambda; \Gamma R; C_{31}^+, \sigma_{db};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	2; $\frac{-\sigma_0-i\sqrt{3}\sigma_2}{2}, \sigma_3;$	WNL;	$\pi$
$S; XR; \sigma_{de}, \mathcal{T}\sigma_{dc};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$Z; XM; C_{2x}, \mathcal{T}C_{2y};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$T; MR; C_{2z}, \sigma_{da}, S_{4z}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0

$\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{\sigma_{da}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^-, C_{2z}, C_{2x}, \sigma_{da}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1, 1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_2), \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	P-WNLs	
	$R_4;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_5;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
$X; (\frac{1}{2}0\frac{1}{2}); S_{4y}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNL $_{\Gamma X};$	
$L; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^+, \sigma_{db}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_3, -\sigma_0;$	P-WNLs;	
$W; (\frac{1}{2}\frac{1}{4}\frac{3}{4}); S_{4x}^+, \mathcal{T}\sigma_{df};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; $i, 1;$		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; $-i, 1;$		
$\Delta; \Gamma X; C_{2y}, \sigma_{dc}, S_{4y}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
$\Lambda; \Gamma L; C_{31}^+, \sigma_{db};$	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma\Sigma; \sigma_{db}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; XS; \sigma_{de}, \mathcal{T}\sigma_{dc};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$Z; XW; C_{2x}, \mathcal{T}C_{2y};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$Q; LW; E, \mathcal{T}\sigma_{df};$	$R_1;$	1; 1, 1;		

SG 217

 $\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{\sigma_{da}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^-, C_{2z}, C_{2x}, \sigma_{da}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1, 1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_2), \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	P-WNLs	
	$R_4;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_5;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^-, C_{2z}, C_{2x}, \sigma_{da}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1, 1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_2), \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	P-WNLs	
	$R_4;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_5;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{31}^-, C_{2z}, C_{2x}, \sigma_{da};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_2), \sigma_0, \sigma_0, \sigma_3;$	P-WNLs	
	$R_4;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, A_{12};$	TP;	0
	$R_5;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, -A_{12};$	TP;	0
$N; (00\frac{1}{2}); C_{2z}, \sigma_{db}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	1; -1, -1, 1;		
$\Sigma; \Gamma N; \sigma_{db}, \mathcal{T} C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Delta; \Gamma H; C_{2y}, \sigma_{de}, S_{4y}^+ \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$\Lambda; \Gamma P; C_{31}^+, \sigma_{db};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3;$	WNL;	$\pi$
$D; \Gamma P; C_{2z}, \sigma_{db};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	1; -1, 1;		
	$R_4;$	1; -1, -1;		
	$R_5;$	1; -1, -1;		
$G; \Gamma N; \sigma_{da}, \mathcal{T} \sigma_{db};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$F; \Gamma H; C_{34}^+, \sigma_{da};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3;$	WNL;	$\pi$

$\Gamma_c; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{\sigma_{da}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000);$	$C_{31}^-, C_{2z}, C_{2x}, \sigma_{da}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
		$R_2;$	1; 1, 1, 1, -1, 1;		
		$R_3;$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_2), \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	P-WNLs	
		$R_4;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
		$R_5;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
$X; (0\frac{1}{2}0);$	$S_{4y}^+, C_{2y}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_7, R_8\};$	2; $-i\sigma_3, \sigma_0, -\sigma_0, \sigma_1;$	P-WNLs;	
		$R_9;$	2; $\sigma_1, -\sigma_0, \sigma_3, -\sigma_0;$	P-WNLs ;	
$M; (\frac{1}{2}\frac{1}{2}0);$	$S_{4z}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$R_3;$	1; -1, 1, 1;		
		$R_4;$	1; -1, -1, 1;		
		$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL <sub>MR</sub> ;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_{4x}^+, \sigma_{da}, C_{33}^-, \mathcal{T};$	$\{R_3, R_4\};$	2; $i\sigma_3, i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_6, R_6\};$	4; $\frac{i(\sqrt{3}\Gamma_{0,1}-\Gamma_{0,2})}{2}, i\Gamma_{0,2}, \frac{-\Gamma_{0,0}+i\sqrt{3}\Gamma_{0,3}}{2}, -\Gamma_{2,2};$	QCDDP;	0
		$\{R_9, R_{10}\};$	6; $-S_{3,1} - \frac{i(S_{3,0}-\sqrt{3}S_{3,8})}{3}, S_{15}, -S_6, S_{1,0};$	SP;	0
$\Delta; \Gamma X;$	$C_{2y}, \sigma_{dc}, S_{4y}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
		$R_2;$	1; 1, -1, 1;		
		$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$\Sigma; \Gamma M;$	$\sigma_{db}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$\Lambda; \Gamma R;$	$C_{31}^+, \sigma_{db};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; 1, -1;		
		$R_3;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3;$	WNL;	$\pi$
$S; XR;$	$\sigma_{de}, \mathcal{T}\sigma_{dc};$	$\{R_1, R_2\};$	2; $-i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Z; XM;$	$C_{2x}, \mathcal{T}C_{2y};$	$R_1;$	1; 1, 1;		
		$R_2;$	1; -1, 1;		
$T; MR;$	$C_{2z}, \sigma_{da}, S_{4z}^+, \mathcal{T};$	$\{R_1, R_2\};$	2; $\sigma_0, -\sigma_3, -i\sigma_2;$	QNL;	0
		$R_3;$	1; -1, -1, 1;		
		$R_4;$	1; -1, 1, 1;		

$\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{\sigma_{da}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^-, C_{2z}, C_{2x}, \sigma_{da}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1, 1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_2), \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	P-WNLs	
	$R_4;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, A_{12}, -\frac{1}{2}i(\sqrt{3} - i)A_0;$	QCTP;	
	$R_5;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, -A_{12}, -\frac{1}{2}i(\sqrt{3} - i)A_0;$	QCTP;	
$X; (\frac{1}{2}0\frac{1}{2}); S_{4y}^+, C_{2x}, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-QNL $_{\Gamma X};$	
$L; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^-, \sigma_{db}, \mathcal{T};$	$\{R_3, R_4\};$	2; $-\sigma_0, i\sigma_3, \sigma_1;$	P-WNLs;	
	$\{R_6, R_6\};$	4; $\frac{1}{2}(\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2}), i\Gamma_{0,3}, -\Gamma_{2,2};$	DP;	0
$W; (\frac{1}{2}\frac{1}{4}\frac{3}{4}); S_{4x}^+, \mathcal{T}\sigma_{df};$	$\{R_1, R_3\};$	2; $\sigma_3, -i\sigma_2;$	P-WNLs;	
	$\{R_2, R_4\};$	2; $i\sigma_3, -i\sigma_2;$	P-WNLs;	
$\Delta; \Gamma X; C_{2y}, \sigma_{dc}, S_{4y}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$\Lambda; \Gamma L; C_{31}^+, \sigma_{db};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma\Sigma; \sigma_{db}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$S; X\bar{S}; \sigma_{de}, \mathcal{T}\sigma_{dc};$	$R_1;$	1; -1, 1;		
	$R_2;$	1; 1, 1;		
$Z; X\bar{W}; C_{2x}, \mathcal{T}C_{2y};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$Q; L\bar{W}; E, \mathcal{T}\sigma_{df};$	$\{R_1, R_1\};$	2; $\sigma_0, -i\sigma_2;$	WNL;	$\pi$

SG 220

 $\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\sigma_{da}|\frac{1}{2}00\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; (000); C_{31}^-, C_{2z}, C_{2x}, \sigma_{da}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1, 1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_2), \sigma_0, \sigma_0, \sigma_3, -\sigma_0;$	P-WNLs	
	$R_4;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, A_{12}, -\frac{1}{2}i(\sqrt{3} - i)A_0;$	QCTP;	
	$R_5;$	3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, -A_{12}, -\frac{1}{2}i(\sqrt{3} - i)A_0;$	QCTP;	
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4x}^+, \sigma_{da}, C_{33}^-, \mathcal{T};$	$\{R_3, R_4\};$	2; $i\sigma_3, i\sigma_3, \sigma_0, \sigma_1;$	P-WNLs;	
	$\{R_6, R_6\};$	4; $\frac{i(\sqrt{3}\Gamma_{0,1} - \Gamma_{0,2})}{2}, i\Gamma_{0,2}, \frac{-\Gamma_{0,0} + i\sqrt{3}\Gamma_{0,3}}{2}, -\Gamma_{2,2};$	QCDDP;	0
	$\{R_9, R_{10}\};$	6; $-S_{3,1} - \frac{i(S_{3,0} - \sqrt{3}S_{3,8})}{3}, S_{15}, -S_6, S_{1,0};$	SP;	0
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{32}^+, C_{2y}, C_{2x}, S_{4x}^+;$	$R_9;$	2; $\frac{\sqrt{3}\sigma_3 - i\sigma_0}{2}, i\sigma_7, \sigma_{24}, \sigma_{25};$	P-WNLs;	
	$R_{10};$	2; $\frac{\sqrt{3}\sigma_3 - i\sigma_0}{2}, i\sigma_7, \sigma_{24}, \sigma_{26};$	P-WNLs;	
	$R_{16};$	4; $\Gamma_{36}, \Gamma_{0,1}, -\Gamma_{0,3}, (\frac{1}{2} + \frac{i}{2})(\Gamma_{3,0} - i\Gamma_{3,3});$	DP;	0
$N; (00\frac{1}{2}); \sigma_{db}, C_{2z}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	P-WNLs;	
$\Sigma; \Gamma N; \sigma_{db}, \mathcal{T}C_{2z};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; -1, 1;		
$\Delta; \Gamma H; C_{2y}, \sigma_{de}, S_{4y}^+, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$\{R_3, R_4\};$	2; $-\sigma_0, \sigma_3, -i\sigma_2;$	QNL;	0
$\Lambda; \Gamma P; C_{31}^+, \sigma_{db};$	$R_1;$	1; 1, 1;		
	$R_2;$	1; 1, -1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3;$	WNL;	$\pi$
$D; NP; C_{2z}, \sigma_{db};$	$R_5;$	2; $\sigma_2, -i\sigma_3;$	WNL;	$\pi$
$G; HN; \sigma_{da}, \mathcal{T}\sigma_{db};$	$\{R_1, R_2\};$	2; $\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$F; PH; C_{34}^+, \sigma_{da};$	$R_3;$	1; $i, -(-1)^{3/4};$		
	$R_4;$	1; $i, (-1)^{3/4};$		
	$R_6;$	2; $-\frac{1}{2}i(\sigma_0 - i\sqrt{3}\sigma_2), -(-1)^{3/4}\sigma_3;$	WNL;	$\pi$



SG 221

 $\Gamma_c; \{S_{61}^-|000\}, \{\sigma_x|000\}, \{\sigma_z|000\}, \{C_{2c}|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
	$R_2; 1; 1, 1, 1, -1, 1;$	
	$R_3; 1; -1, -1, -1, -1, 1;$	
	$R_4; 1; -1, -1, -1, 1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs
	$R_6; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs
	$R_7; 3; A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;
	$R_8; 3; A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;
	$R_9; 3; -A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;
	$R_{10}; 3; -A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;
$X; (0\frac{1}{2}0); C_{4y}^+, C_{2z}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; 1, -1, 1, 1;$	
	$R_3; 1; -1, 1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma X}$
	$R_6; 1; 1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, 1, -1, 1;$	
	$R_9; 1; -1, -1, -1, 1;$	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma X}$
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; 1, -1, 1, 1;$	
	$R_3; 1; -1, 1, 1, 1;$	
	$R_4; 1; -1, -1, 1, 1;$	
	$R_5; 2; i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{MR}$
	$R_6; 1; 1, 1, -1, 1;$	
	$R_7; 1; 1, -1, -1, 1;$	
	$R_8; 1; -1, 1, -1, 1;$	
	$R_9; 1; -1, -1, -1, 1;$	
	$R_{10}; 2; i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{MR}$
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$	
	$R_2; 1; 1, 1, 1, -1, 1;$	
	$R_3; 1; -1, -1, -1, -1, 1;$	
	$R_4; 1; -1, -1, -1, 1, 1;$	
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs
	$R_6; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs
	$R_7; 3; A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;
	$R_8; 3; A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;
	$R_9; 3; -A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;
	$R_{10}; 3; -A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	QNL; 0
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 1; -1, 1, 1;	
	$R_4$ ; 1; -1, -1, 1;	
	$R_5$ ; 2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 1; -1, 1, 1;	
	$R_4$ ; 1; -1, -1, 1;	
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, \sigma_{db}, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0$ ; WNL; $\pi$	
$S$ ; $XR$ ; $C_{2c}, \sigma_y, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 1; -1, 1, 1;	
	$R_4$ ; 1; -1, -1, 1;	
$Z$ ; $XM$ ; $C_{2x}, \sigma_z, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 1; -1, 1, 1;	
	$R_4$ ; 1; -1, -1, 1;	
$T$ ; $MR$ ; $C_{4z}^+, \sigma_y, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	QNL; 0
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 1; -1, 1, 1;	
	$R_4$ ; 1; -1, -1, 1;	
	$R_5$ ; 2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	

$\Gamma_c$ ;  $\{S_{61}^-|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_x|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_z|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{C_{2c}|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; (000); $S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1, 1, 1;		
	$R_2$ ;	1; 1, 1, 1, -1, 1;		
	$R_3$ ;	1; -1, -1, -1, -1, 1;		
	$R_4$ ;	1; -1, -1, -1, 1, 1;		
	$R_5$ ;	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs	
	$R_6$ ;	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs	
	$R_7$ ;	3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
	$R_8$ ;	3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
	$R_9$ ;	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
	$R_{10}$ ;	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
$X$ ; $(0\frac{1}{2}0)$ ; $I, \sigma_x, C_{4y}^-, \mathcal{T}$ ;	$R_{10}$ ;	2; $-\sigma_3, i\sigma_2, \sigma_0, -\sigma_0$ ;	P-WNLs;	
	$R_{11}$ ;	2; $-\sigma_3, i\sigma_2, -\sigma_0, -\sigma_0$ ;	P-WNLs;	
	$\{R_{12}, R_{13}\}$ ;	4; $-\Gamma_{0,3}, i\Gamma_{0,2}, -i\Gamma_{3,3}, \Gamma_{1,0}$ ;	QDP;	0
$M$ ; $(\frac{1}{2}\frac{1}{2}0)$ ; $C_{4z}^-, \sigma_x, C_{2x}, \mathcal{T}$ ;	$R_9$ ;	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0$ ;	P-WNLs;	
	$R_{11}$ ;	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0$ ;	P-WNLs;	
	$R_{12}$ ;	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0$ ;	P-WNLs;	
	$R_{14}$ ;	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0$ ;	P-WNLs;	
$R$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $C_{32}^-, C_{2x}, C_{2y}, C_{2f}, I, \mathcal{T}$ ;	$R_7$ ;	2; $-\sigma_0, \sigma_0, \sigma_0, \sigma_1, \sigma_3, -\sigma_0$ ;	P-WNLs;	
	$\{R_8, R_9\}$ ;	4; $\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,0}, \Gamma_{0,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0}$ ;	QCDDP;	0
	$R_{14}$ ;	6; $S_1, S_2, S_3, S_4, S_5, -S_{0,0}$ ;	SP;	0
$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, I\mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;		
	$R_2$ ;	1; 1, -1, 1;		
	$R_3$ ;	1; -1, 1, 1;		
	$R_4$ ;	1; -1, -1, 1;		
	$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	QNL;	0
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;		
	$R_2$ ;	1; 1, -1, 1;		
	$R_3$ ;	1; -1, 1, 1;		
	$R_4$ ;	1; -1, -1, 1;		
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, \sigma_{db}, I\mathcal{T}$ ;	$R_1$ ;	1; 1, 1, 1;		
	$R_2$ ;	1; 1, -1, 1;		
	$R_3$ ;	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0$ ;	WNL;	$\pi$
$S$ ; XR; $\sigma_y, C_{2c}, I\mathcal{T}$ ;	$R_5$ ;	2; $\sigma_2, \sigma_3, -i\sigma_1$ ;	WNL;	$\pi$
$Z$ ; XM; $\sigma_y, C_{2x}, I\mathcal{T}$ ;	$R_5$ ;	2; $\sigma_2, \sigma_3, -i\sigma_1$ ;	WNL;	$\pi$
$T$ ; MR; $C_{4z}^+, C_{2z}, \sigma_{da}, I\mathcal{T}$ ;	$R_5$ ;	1; $i, -1, -1, 1$ ;		
	$R_6$ ;	1; $-i, -1, -1, 1$ ;		
	$R_7$ ;	1; $-i, -1, 1, 1$ ;		
	$R_8$ ;	1; $i, -1, 1, 1$ ;		
	$R_9$ ;	2; $\sigma_1, \sigma_0, -\sigma_3, -i\sigma_3$ ;	QNL;	0

$\Gamma_c; \{S_{61}^-|000\}, \{\sigma_x|000\}, \{\sigma_z|000\}, \{C_{2c}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1, 1;		
	$R_3;$	1; -1, -1, -1, -1, 1;		
	$R_4;$	1; -1, -1, -1, 1, 1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs	
	$R_6;$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs	
	$R_7;$	3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_8;$	3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_9;$	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_{10};$	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
$X; (0\frac{1}{2}0); S_{4y}^+, \sigma_{dc}, C_{2c}, \mathcal{T};$	$R_9;$	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11};$	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12};$	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{14};$	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^-, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1;		
	$R_3;$	1; -1, 1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL <sub>MR</sub>	
	$R_6;$	1; 1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, 1, -1, 1;		
	$R_9;$	1; -1, -1, -1, 1;		
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL <sub>MR</sub>	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{32}^-, C_{2x}, C_{2y}, C_{2f}, I, \mathcal{T};$	$R_7;$	2; $-\sigma_0, \sigma_0, \sigma_0, \sigma_1, \sigma_3, -\sigma_0;$	P-WNLs;	
	$\{R_8, R_9\};$	4; $\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, \Gamma_{0,0}, \Gamma_{0,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	QCDDP;	0
	$R_{14};$	6; $S_1, S_2, S_3, S_4, S_5, -S_{0,0};$	SP;	0
$\Delta; \Gamma X; C_{4y}^+, \sigma_x, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Lambda; \Gamma R; C_{31}^+, \sigma_{db}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0;$	WNL;	$\pi$
$S; XR; C_{2c}, \sigma_y, I, \mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -\sigma_0;$	WNL;	$\pi$
$Z; XM; C_{2x}, \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		

$$\begin{aligned} T; \text{ MR}; C_{4z}^+, \sigma_x, E, IT; R_6; \quad & 1; -1, 1, 1, 1; \\ R_7; \quad & 1; -1, -1, 1, 1; \\ R_8; \quad & 1; 1, 1, 1, 1; \\ R_9; \quad & 1; 1, -1, 1, 1; \\ R_{10}; \quad & 2; -i\sigma_2, \sigma_3, \sigma_0, -\sigma_0; \text{ QNL}; 0 \end{aligned}$$

SG 224

 $\Gamma_c; \{S_{61}^- | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\sigma_x | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\sigma_z | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2c} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$		
	$R_2; 1; 1, 1, 1, -1, 1;$		
	$R_3; 1; -1, -1, -1, -1, 1;$		
	$R_4; 1; -1, -1, -1, 1, 1;$		
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs	
	$R_6; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs	
	$R_7; 3; A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_8; 3; A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_9; 3; -A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_{10}; 3; -A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
$X; (0\frac{1}{2}0); C_{4y}^-, \sigma_x, C_{2x}, \mathcal{T};$	$R_9; 2; \sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11}; 2; -i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12}; 2; -\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{14}; 2; -i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^-, \sigma_y, C_{2y}, \mathcal{T};$	$R_9; 2; \sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{11}; 2; -i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{12}; 2; -\sigma_1, i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
	$R_{14}; 2; -i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0;$	P-WNLs;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1, 1;$		
	$R_2; 1; 1, 1, 1, -1, 1;$		
	$R_3; 1; -1, -1, -1, -1, 1;$		
	$R_4; 1; -1, -1, -1, 1, 1;$		
	$R_5; 2; \frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs	
	$R_6; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs	
	$R_7; 3; A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_8; 3; A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_9; 3; -A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_{10}; 3; -A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
$\Delta; \Gamma X; C_{4y}^+, \sigma_x, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 1; -1, 1, 1;$		
	$R_4; 1; -1, -1, 1;$		
	$R_5; 2; i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 1; -1, 1, 1;$		
	$R_4; 1; -1, -1, 1;$		
$\Lambda; \Gamma R; C_{31}^+, \sigma_{db}, I\mathcal{T};$	$R_1; 1; 1, 1, 1;$		
	$R_2; 1; 1, -1, 1;$		
	$R_3; 2; \frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0;$	WNL;	$\pi$
$S; XR; C_{2c}, \sigma_{de}, I\mathcal{T};$	$R_2; 1; 1, 1, 1;$		
	$R_4; 1; -1, 1, 1;$		
	$R_6; 1; 1, -1, 1;$		
	$R_8; 1; -1, -1, 1;$		
$Z; XM; \sigma_y, C_{2x}, I\mathcal{T};$	$R_5; 2; \sigma_2, \sigma_3, -i\sigma_1;$	WNL;	$\pi$

$$\begin{aligned} T; \text{ MR}; \sigma_x, C_{2z}, \sigma_{db}, IT; R_5; \quad 1; -i, 1, 1, 1; \\ R_6; \quad 1; i, 1, 1, 1; \\ R_7; \quad 1; i, 1, -1, 1; \\ R_8; \quad 1; -i, 1, -1, 1; \\ R_{10}; \quad 2; -i\sigma_2, -\sigma_0, \sigma_3, -i\sigma_3; \text{ QNL}; 0 \end{aligned}$$

$\Gamma_c^f$ ;  $\{S_{61}^-|000\}, \{\sigma_x|000\}, \{\sigma_z|000\}, \{C_{2c}|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; (000); $S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1, 1, 1;		
$R_2$ ; 1; 1, 1, 1, -1, 1;		
$R_3$ ; 1; -1, -1, -1, -1, 1;		
$R_4$ ; 1; -1, -1, -1, 1, 1;		
$R_5$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs	
$R_6$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs	
$R_7$ ; 3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
$R_8$ ; 3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
$R_9$ ; 3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
$R_{10}$ ; 3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
$X$ ; $(\frac{1}{2}0\frac{1}{2})$ ; $C_{4y}^+, C_{2x}, I, \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1, 1;		
$R_2$ ; 1; 1, -1, 1, 1;		
$R_3$ ; 1; -1, 1, 1, 1;		
$R_4$ ; 1; -1, -1, 1, 1;		
$R_5$ ; 2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0$ ;	P-QNL $_{\Gamma X}$	
$R_6$ ; 1; 1, 1, -1, 1;		
$R_7$ ; 1; 1, -1, -1, 1;		
$R_8$ ; 1; -1, 1, -1, 1;		
$R_9$ ; 1; -1, -1, -1, 1;		
$R_{10}$ ; 2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0$ ;	P-QNL $_{\Gamma X}$	
$L$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $S_{61}^+, C_{2b}, \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1;		
$R_2$ ; 1; 1, -1, 1;		
$R_3$ ; 1; -1, 1, 1;		
$R_4$ ; 1; -1, -1, 1;		
$R_5$ ; 2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0$ ;	P-WNLs	
$R_6$ ; 2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0$ ;	P-WNLs	
$W$ ; $(\frac{1}{2}\frac{1}{2}\frac{3}{4})$ ; $S_{4x}^+, C_{2d}, I, \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1;		
$R_2$ ; 1; 1, -1, 1;		
$R_3$ ; 1; -1, 1, 1;		
$R_4$ ; 1; -1, -1, 1;		
$R_5$ ; 2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	P-WNLs;	
$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, I, \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1;		
$R_2$ ; 1; 1, -1, 1;		
$R_3$ ; 1; -1, 1, 1;		
$R_4$ ; 1; -1, -1, 1;		
$R_5$ ; 2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	QNL;	0
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, \sigma_{db}, I, \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1;		
$R_2$ ; 1; 1, -1, 1;		
$R_3$ ; 2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0$ ;	WNL;	$\pi$
$\Sigma$ ; $\Gamma \Sigma$ ; $C_{2a}, \sigma_z, I, \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1;		
$R_2$ ; 1; 1, -1, 1;		
$R_3$ ; 1; -1, 1, 1;		
$R_4$ ; 1; -1, -1, 1;		



$$\begin{array}{l} S; \text{ XS}; \ C_{2c,\sigma_y,I\mathcal{T}}; \ R_1; \ 1; \ 1, 1, 1; \\ \qquad \qquad \qquad R_2; \ 1; \ 1, -1, 1; \\ \qquad \qquad \qquad R_3; \ 1; \ -1, 1, 1; \\ \qquad \qquad \qquad R_4; \ 1; \ -1, -1, 1; \\ Z; \text{ XW}; \ C_{2x,\sigma_z,I\mathcal{T}}; \ R_1; \ 1; \ 1, 1, 1; \\ \qquad \qquad \qquad R_2; \ 1; \ 1, -1, 1; \\ \qquad \qquad \qquad R_3; \ 1; \ -1, 1, 1; \\ \qquad \qquad \qquad R_4; \ 1; \ -1, -1, 1; \\ Q; \text{ LW}; \ C_{2f,I\mathcal{T}}; \ R_1; \ 1; \ 1, 1; \\ \qquad \qquad \qquad R_2; \ 1; \ -1, 1; \end{array}$$

$\Gamma_c^f; \{S_{61}^-|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_x|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_z|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{C_{2c}|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1, 1;		
	$R_3;$	1; -1, -1, -1, -1, 1;		
	$R_4;$	1; -1, -1, -1, 1, 1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs	
	$R_6;$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs	
	$R_7;$	3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_8;$	3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_9;$	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_{10};$	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
$X; (\frac{1}{2}0\frac{1}{2}); C_{4y}^+, C_{2x}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1;		
	$R_2;$	1; 1, -1, 1, 1;		
	$R_3;$	1; -1, 1, 1, 1;		
	$R_4;$	1; -1, -1, 1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-QNL $_{\Gamma X}$	
	$R_6;$	1; 1, 1, -1, 1;		
	$R_7;$	1; 1, -1, -1, 1;		
	$R_8;$	1; -1, 1, -1, 1;		
	$R_9;$	1; -1, -1, -1, 1;		
	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-QNL $_{\Gamma X}$	
$L; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); \sigma_{db}, C_{31}^-, I, \mathcal{T};$	$\{R_7, R_8\};$	4; $-i\Gamma_{3,1}, \frac{1}{2}(-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}), \Gamma_{0,3}, \Gamma_{1,0};$	DP;	0
	$R_9;$	2; $i\sigma_1, \sigma_0, \sigma_3, -i\sigma_3;$	P-WNLs;	
$W; (\frac{1}{2}\frac{1}{4}\frac{3}{4}); S_{4x}^-, E, C_{2d}, I, \mathcal{T};$	$\{R_{13}, R_{16}\};$	2; $i\sigma_3, -i\sigma_0, \sigma_3, \sigma_1;$	P-WNLs;	
	$\{R_{14}, R_{15}\};$	2; $i\sigma_3, -i\sigma_0, -\sigma_3, \sigma_1;$	P-WNLs;	
	$R_{20};$	2; $\sigma_3, -i\sigma_0, \sigma_1, -i\sigma_3;$	P-WNLs;	
$\Delta; \Gamma X; C_{4y}^+, \sigma_x, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
$\Lambda; \Gamma L; C_{31}^+, \sigma_{db}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0;$	WNL;	$\pi$
$\Sigma; \Gamma \Sigma; C_{2a}, \sigma_z, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$S; X S; C_{2c}, \sigma_y, I, \mathcal{T};$	$R_1;$	1; 1, -1, 1;		
	$R_2;$	1; 1, 1, 1;		
	$R_3;$	1; -1, -1, 1;		
	$R_4;$	1; -1, 1, 1;		

$$\begin{array}{llll} Z; \text{ XW}; C_{2x,\sigma_z,IT}; R_1; & 1; 1, -1, 1; \\ & R_2; & 1; 1, 1, 1; \\ & R_3; & 1; -1, -1, 1; \\ & R_4; & 1; -1, 1, 1; \\ Q; \text{ LW}; C_{2f,IT}; \{R_1, R_2\}; 2; \sigma_3, \sigma_1; & \text{WNL}; \pi \end{array}$$

$\Gamma_c^f$ ;  $\{S_{61}^-|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \{\sigma_x|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \{\sigma_z|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \{C_{2c}|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; (000); $S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T}$ ; $R_1$ ; 1; 1, 1, 1, 1, 1;			
	$R_2$ ; 1; 1, 1, 1, -1, 1;		
	$R_3$ ; 1; -1, -1, -1, -1, 1;		
	$R_4$ ; 1; -1, -1, -1, 1, 1;		
	$R_5$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs	
	$R_6$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs	
	$R_7$ ; 3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
	$R_8$ ; 3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
	$R_9$ ; 3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
	$R_{10}$ ; 3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
$X$ ; $(\frac{1}{2}0\frac{1}{2})$ ; $\sigma_x, S_{4y}^+, C_{2x}, \mathcal{T}$ ;	$R_{10}$ ; 2; $-i\sigma_2, \sigma_1, \sigma_1, -\sigma_0$ ;	P-WNLs;	
	$R_{11}$ ; 2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0$ ;	P-WNLs;	
	$R_{13}$ ; 2; $-i\sigma_2, -\sigma_1, \sigma_1, -\sigma_0$ ;	P-WNLs;	
	$R_{14}$ ; 2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0$ ;	P-WNLs;	
$L$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $S_{61}^+, C_{2b}, \mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;		
	$R_2$ ; 1; 1, -1, 1;		
	$R_3$ ; 1; -1, 1, 1;		
	$R_4$ ; 1; -1, -1, 1;		
	$R_5$ ; 2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0$ ;	P-WNLs	
	$R_6$ ; 2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0$ ;	P-WNLs	
$W$ ; $(\frac{1}{2}\frac{1}{4}\frac{3}{4})$ ; $S_{4x}^+, E, C_{2f}, I\mathcal{T}$ ;	$R_{11}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), i\sigma_0, \sigma_1, -i\sigma_1$ ;	P-WNL <sub>XW</sub> ;	
	$R_{12}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), i\sigma_0, \sigma_1, -i\sigma_1$ ;	P-WNL <sub>XW</sub> ;	
$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;		
	$R_2$ ; 1; 1, -1, 1;		
	$R_3$ ; 1; -1, 1, 1;		
	$R_4$ ; 1; -1, -1, 1;		
	$R_5$ ; 2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	QNL;	0
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, \sigma_{db}, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;		
	$R_2$ ; 1; 1, -1, 1;		
	$R_3$ ; 2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0$ ;	WNL;	$\pi$
$\Sigma$ ; $\Gamma\Sigma$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;		
	$R_2$ ; 1; 1, -1, 1;		
	$R_3$ ; 1; -1, 1, 1;		
	$R_4$ ; 1; -1, -1, 1;		
$S$ ; $XS$ ; $\sigma_y, \sigma_{de}, I\mathcal{T}$ ;	$R_2$ ; 1; 1, 1, 1;		
	$R_4$ ; 1; -1, 1, 1;		
	$R_6$ ; 1; 1, -1, 1;		
	$R_8$ ; 1; -1, -1, 1;		
$Z$ ; $XW$ ; $\sigma_y, \sigma_z, I\mathcal{T}$ ;	$R_5$ ; 2; $\sigma_2, -i\sigma_3, -i\sigma_3$ ;	WNL;	$\pi$
$Q$ ; $LW$ ; $C_{2f}, I\mathcal{T}$ ;	$R_4$ ; 1; 1, 1;		
	$R_8$ ; 1; -1, 1;		

$\Gamma_c^f$ ;  $\{S_{61}^-|\frac{3}{4}\frac{3}{4}\frac{3}{4}\}, \{\sigma_x|\frac{3}{4}\frac{3}{4}\frac{3}{4}\}, \{\sigma_z|\frac{3}{4}\frac{3}{4}\frac{3}{4}\}, \{C_{2c}|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; (000); $S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T}$ ; $R_1$ ;	1; 1, 1, 1, 1, 1;		
$R_2$ ;	1; 1, 1, 1, -1, 1;		
$R_3$ ;	1; -1, -1, -1, -1, 1;		
$R_4$ ;	1; -1, -1, -1, 1, 1;		
$R_5$ ;	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs	
$R_6$ ;	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs	
$R_7$ ;	3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
$R_8$ ;	3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
$R_9$ ;	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
$R_{10}$ ;	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;	
$X$ ; $(\frac{1}{2}0\frac{1}{2})$ ; $C_{4y}^-, \sigma_x, C_{2x}, \mathcal{T}$ ; $R_9$ ;	2; $\sigma_1, i\sigma_2, \sigma_1, -\sigma_0$ ;	P-WNLs;	
$R_{11}$ ;	2; $-i\sigma_2, i\sigma_2, \sigma_1, -\sigma_0$ ;	P-WNLs;	
$R_{12}$ ;	2; $-\sigma_1, i\sigma_2, \sigma_1, -\sigma_0$ ;	P-WNLs;	
$R_{14}$ ;	2; $-i\sigma_2, -i\sigma_2, \sigma_1, -\sigma_0$ ;	P-WNLs;	
$L$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $\sigma_{db}, C_{31}^-, I, \mathcal{T}$ ; $\{R_7, R_8\}$ ;	4; $-i\Gamma_{3,1}, \frac{1}{2}(-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}), \Gamma_{0,3}, \Gamma_{1,0}$ ;	DP;	0
$R_9$ ;	2; $i\sigma_1, \sigma_0, \sigma_3, -i\sigma_3$ ;	P-WNLs;	
$W$ ; $(\frac{1}{2}\frac{1}{4}\frac{3}{4})$ ; $S_{4x}^+, E, C_{2d}, I\mathcal{T}$ ; $\{R_{13}, R_{14}\}$ ;	4; $(\frac{1}{2} - \frac{i}{2})(\Gamma_{0,3} + i\Gamma_{3,0}), -i\Gamma_{0,0}, \Gamma_{3,1}, \Gamma_{1,0}$ ;	DP;	0
$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, I\mathcal{T}$ ; $R_1$ ;	1; 1, 1, 1;		
$R_2$ ;	1; 1, -1, 1;		
$R_3$ ;	1; -1, 1, 1;		
$R_4$ ;	1; -1, -1, 1;		
$R_5$ ;	2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	QNL;	0
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, \sigma_{db}, I\mathcal{T}$ ; $R_1$ ;	1; 1, 1, 1;		
$R_2$ ;	1; 1, -1, 1;		
$R_3$ ;	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0$ ;	WNL;	$\pi$
$\Sigma$ ; $\Gamma\Sigma$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ; $R_1$ ;	1; 1, 1, 1;		
$R_2$ ;	1; 1, -1, 1;		
$R_3$ ;	1; -1, 1, 1;		
$R_4$ ;	1; -1, -1, 1;		
$S$ ; $XS$ ; $\sigma_y, \sigma_{de}, I\mathcal{T}$ ; $R_2$ ;	1; -1, -1, 1;		
$R_4$ ;	1; 1, -1, 1;		
$R_6$ ;	1; -1, 1, 1;		
$R_8$ ;	1; 1, 1, 1;		
$Z$ ; $XW$ ; $\sigma_y, \sigma_z, I\mathcal{T}$ ; $R_5$ ;	2; $-\sigma_2, i\sigma_3, -i\sigma_3$ ;	WNL;	$\pi$
$Q$ ; $LW$ ; $C_{2f}, I\mathcal{T}$ ; $\{R_4, R_8\}$ ;	2; $\sigma_3, \sigma_1$ ;	WNL;	$\pi$

$\Gamma_c^v$ ;  $\{S_{61}^-|000\}, \{\sigma_x|000\}, \{\sigma_z|000\}, \{C_{2c}|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$\Gamma$ ; (000); $S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1, 1, 1;	
	$R_2$ ; 1; 1, 1, 1, -1, 1;	
	$R_3$ ; 1; -1, -1, -1, -1, 1;	
	$R_4$ ; 1; -1, -1, -1, 1, 1;	
	$R_5$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs
	$R_6$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs
	$R_7$ ; 3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;
	$R_8$ ; 3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;
	$R_9$ ; 3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;
	$R_{10}$ ; 3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;
$H$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1, 1, 1;	
	$R_2$ ; 1; 1, 1, 1, -1, 1;	
	$R_3$ ; 1; -1, -1, -1, -1, 1;	
	$R_4$ ; 1; -1, -1, -1, 1, 1;	
	$R_5$ ; 2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs
	$R_6$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0$ ;	P-WNLs
	$R_7$ ; 3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;
	$R_8$ ; 3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;
	$R_9$ ; 3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;
	$R_{10}$ ; 3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	QCTP;
$P$ ; $(\frac{1}{4}\frac{1}{4}\frac{1}{4})$ ; $C_{31}^-, C_{2z}, C_{2x}, \sigma_{da}, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1, 1, 1;	
	$R_2$ ; 1; 1, 1, 1, -1, 1;	
	$R_3$ ; 2; $\frac{-\sigma_0 + i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \sigma_3, -\sigma_0$ ;	P-WNLs ;
	$R_4$ ; 3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	TP; 0
	$R_5$ ; 3; $A_{11}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{13}, -A_{12}, -\frac{i(\sqrt{3}-i)A_0}{2}$ ;	TP; 0
$N$ ; $(00\frac{1}{2})$ ; $C_{2z}, C_{2b}, I, \mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1, 1;	
	$R_2$ ; 1; -1, 1, 1, 1;	
	$R_3$ ; 1; 1, -1, 1, 1;	
	$R_4$ ; 1; -1, -1, 1, 1;	
	$R_5$ ; 1; 1, 1, -1, 1;	
	$R_6$ ; 1; -1, 1, -1, 1;	
	$R_7$ ; 1; 1, -1, -1, 1;	
	$R_8$ ; 1; -1, -1, -1, 1;	
$\Sigma$ ; $\Gamma N$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 1; -1, 1, 1;	
	$R_4$ ; 1; -1, -1, 1;	
$\Delta$ ; $\Gamma H$ ; $C_{4y}^+, \sigma_x, I\mathcal{T}$ ;	$R_1$ ; 1; 1, 1, 1;	
	$R_2$ ; 1; 1, -1, 1;	
	$R_3$ ; 1; -1, 1, 1;	
	$R_4$ ; 1; -1, -1, 1;	
	$R_5$ ; 2; $i\sigma_2, \sigma_3, -\sigma_0$ ;	QNL; 0

$$\begin{aligned}
&\Lambda; \text{ GP}; \ C_{31}^+, \sigma_{db}, I\mathcal{T}; \ R_1; \ 1; \ 1, 1, 1; \\
&\quad R_2; \ 1; \ 1, -1, 1; \\
&\quad R_3; \ 2; \ \tfrac{1}{2} \left( -\sigma_0 - i\sqrt{3}\sigma_2 \right), \sigma_3, -\sigma_0; \text{ WNL}; \ \pi \\
&D; \text{ NP}; \ C_{2z}, \sigma_{db}, I\mathcal{T}; \ R_1; \ 1; \ 1, 1, 1; \\
&\quad R_2; \ 1; \ 1, -1, 1; \\
&\quad R_3; \ 1; \ -1, 1, 1; \\
&\quad R_4; \ 1; \ -1, -1, 1; \\
&G; \text{ HN}; \ C_{2b}, \sigma_{da}, I\mathcal{T}; \ R_1; \ 1; \ 1, 1, 1; \\
&\quad R_2; \ 1; \ 1, -1, 1; \\
&\quad R_3; \ 1; \ -1, 1, 1; \\
&\quad R_4; \ 1; \ -1, -1, 1; \\
&F; \text{ PH}; \ C_{34}^+, \sigma_{da}, I\mathcal{T}; \ R_1; \ 1; \ 1, 1, 1; \\
&\quad R_2; \ 1; \ 1, -1, 1; \\
&\quad R_3; \ 2; \ \tfrac{1}{2} \left( -\sigma_0 - i\sqrt{3}\sigma_2 \right), \sigma_3, -\sigma_0; \text{ WNL}; \ \pi
\end{aligned}$$

$\Gamma_c^v; \{S_{61}^-|000\}, \{\sigma_x|\frac{1}{2}\frac{1}{2}0\}, \{\sigma_z|\frac{1}{2}0\frac{1}{2}\}, \{C_{2c}|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$\Gamma; (000); S_{61}^-, \sigma_x, \sigma_z, C_{2c}, \mathcal{T};$	$R_1;$	1; 1, 1, 1, 1, 1;		
	$R_2;$	1; 1, 1, 1, -1, 1;		
	$R_3;$	1; -1, -1, -1, -1, 1;		
	$R_4;$	1; -1, -1, -1, 1, 1;		
	$R_5;$	2; $\frac{-\sigma_0 - i\sqrt{3}\sigma_2}{2}, \sigma_0, \sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs	
	$R_6;$	2; $\frac{\sigma_0 + i\sqrt{3}\sigma_2}{2}, -\sigma_0, -\sigma_0, \frac{\sqrt{3}\sigma_1 - \sigma_3}{2}, -\sigma_0;$	P-WNLs	
	$R_7;$	3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_8;$	3; $A_9, A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_9;$	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
	$R_{10};$	3; $-A_9, -A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, -A_{15}, -\frac{i(\sqrt{3}-i)A_0}{2};$	QCTP;	
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{32}^-, C_{2x}, C_{2y}, \sigma_{da}, I, \mathcal{T};$	$R_7;$	2; $-\sigma_0, -\sigma_0, -\sigma_0, -\sigma_3, \sigma_1, -\sigma_0;$	P-WNLs;	
	$\{R_8, R_9\};$	4; $\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, -\Gamma_{0,0}, -\Gamma_{0,0}, \Gamma_{0,1}, \Gamma_{0,3}, \Gamma_{1,0};$	QCDP;	0
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{32}^+, C_{2y}, C_{2x}, S_{4x}^+, I, \mathcal{T};$	$R_{14};$	6; $S_6, S_7, \frac{S_{0,0} + 2\sqrt{3}S_{0,8}}{3}, iS_8, S_{1,0}, -iS_{1,0};$	SP;	0
	$\{R_9, R_{10}\};$	4; $\frac{\sqrt{3}\Gamma_{3,3} - i\Gamma_{0,0}}{2}, i\Gamma_9, \Gamma_{37}, \Gamma_{38}, \Gamma_{1,0};$	DP;	0
$N; (00\frac{1}{2}); \sigma_{db}, C_{2b}, C_{2a}, \mathcal{T};$	$R_{16};$	4; $\Gamma_{36}, \Gamma_{0,1}, -\Gamma_{0,3}, \frac{1+i}{2}(\Gamma_{3,0} - i\Gamma_{3,3})\Gamma_{2,2};$	DP;	0
	$R_5;$	2; $i\sigma_2, \sigma_3, \sigma_0, -\sigma_0;$	P-WNLs;	
$\Sigma; \Gamma N; C_{2a}, \sigma_z, I, \mathcal{T};$	$R_{10};$	2; $i\sigma_2, \sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;	
	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
$\Delta; \Gamma H; C_{4y}^+, \sigma_x, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	1; -1, 1, 1;		
	$R_4;$	1; -1, -1, 1;		
	$R_5;$	2; $i\sigma_2, \sigma_3, -\sigma_0;$	QNL;	0
$\Lambda; \Gamma P; C_{31}^+, \sigma_{db}, I, \mathcal{T};$	$R_1;$	1; 1, 1, 1;		
	$R_2;$	1; 1, -1, 1;		
	$R_3;$	2; $\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -\sigma_0;$	WNL;	$\pi$
$D; \text{NP}; C_{2z}, \sigma_{db}, I, \mathcal{T};$	$R_5;$	2; $\sigma_2, -i\sigma_3, -\sigma_0;$	WNL;	$\pi$
$G; \text{HN}; C_{2b}, \sigma_{da}, I, \mathcal{T};$	$R_5;$	2; $\sigma_2, \sigma_3, -\sigma_0;$	WNL;	$\pi$
$F; \text{PH}; C_{34}^+, \sigma_{da}, I, \mathcal{T};$	$R_3;$	1; $i, (-1)^{3/4}, 1;$		
	$R_4;$	1; $i, (-1)^{3/4}, 1;$		
	$R_6;$	2; $-\frac{i(\sigma_0 - i\sqrt{3}\sigma_2)}{2}, -(-1)^{3/4}\sigma_3, -\sigma_0;$	WNL;	$\pi$



## B. The accidental degeneracies on high-symmetry line

### 1. Notes to Sec. S7B

- (i) For each table in Sec. S7B, the first line presents the SG number.
- (ii) Below the first line, the columns from left to right (separated by the semicolons) are the high-symmetry momentum  $\mathbf{k}$ , the location of  $\mathbf{k}$ , the generating elements of the little group at  $\mathbf{k}$  (only point-group operators are presented and a full expression of each generating element can be found in Sec. S5), the two distinct coreps (separated by the comma) of the bands forming the accidental degeneracy, the degeneracy of the accidental degeneracy, the matrix representations of the generating elements, the species and the topological charge of the accidental degeneracy.
- (iii) We do not list the type II MSGs that do not exhibit symmetry-protected accidental degeneracies on high-symmetry line.

### 2. SG 1-10

## SG 3

---

Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $V$ ; BD;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $W$ ; YC;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $U$ ; AE;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1

## SG 4

---

Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $V$ ; BD;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $W$ ; YC;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $U$ ; AE;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1

## SG 5

---

Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $U$ ; AM;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1

## SG 10

---

Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $V$ ; BD;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $W$ ; YC;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $U$ ; AE;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;

## SG 11

---

Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $V$ ; BD;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $W$ ; YC;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $U$ ; AE;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;

## SG 12

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $U$ ; AM;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;

## SG 13

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $W$ ; YC;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;

## SG 14

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $W$ ; YC;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;

## SG 15

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;

## SG 16

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma Y$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $D$ ;  $XS$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $P$ ;  $UR$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $B$ ;  $ZT$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma X$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $C$ ;  $YS$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $E$ ;  $TR$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $A$ ;  $ZU$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $H$ ;  $YT$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $SR$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $G$ ;  $XU$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 17

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma Y$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $D$ ;  $XS$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma X$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $C$ ;  $YS$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $H$ ;  $YT$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $SR$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $G$ ;  $XU$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 18

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma Y$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $B$ ;  $ZT$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma X$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $A$ ;  $ZU$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $SR$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1, R_1\}, \{R_2, R_2\}$ ; 4;  $\Gamma_{3,0}, -i\Gamma_{0,2}$ ; C-2 DP; 2

## SG 19

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y}, \mathcal{TC}_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$P$ ; $UR$ ; $C_{2y}, \mathcal{TC}_{2x}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ; C-2 DP; 2
$\Sigma$ ; $\Gamma X$ ; $C_{2x}, \mathcal{TC}_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$E$ ; $TR$ ; $C_{2x}, \mathcal{TC}_{2z}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ; C-2 DP; 2
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \mathcal{TC}_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$Q$ ; $SR$ ; $C_{2z}, \mathcal{TC}_{2x}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $-\Gamma_{3,0}, -i\Gamma_{0,2}$ ; C-2 DP; 2

## SG 20

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 Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \mathcal{TC}_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$H$ ; $YT$ ; $C_{2z}, \mathcal{TC}_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$D$ ; $SR$ ; $C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; C-1 WP; 1
$\Sigma$ ; $\Gamma Y$ ; $C_{2x}, \mathcal{TC}_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Delta$ ; $\Gamma \Delta$ ; $C_{2y}, \mathcal{TC}_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$F$ ; $YF$ ; $C_{2y}, \mathcal{TC}_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$C$ ; $YC$ ; $C_{2x}, \mathcal{TC}_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1

## 4. SG 21-30

## SG 21

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $H$ ;  $YT$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $D$ ;  $SR$ ;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $A$ ;  $ZT$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma Y$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Delta$ ;  $\Gamma \Delta$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $B$ ;  $ZB$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $G$ ;  $TG$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $F$ ;  $YF$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $E$ ;  $TE$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $C$ ;  $YC$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 22

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z/\Gamma \Lambda$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $G$ ;  $XG/XY$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $H$ ;  $YH/YX$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $ZQ$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma X/\Gamma \Sigma$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $C$ ;  $YC/YZ$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $A$ ;  $ZA/ZY$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $U$ ;  $XU$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Delta$ ;  $\Gamma Y/\Gamma \Delta$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $D$ ;  $XD/XZ$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $B$ ;  $ZB/ZX$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $R$ ;  $YR$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 23

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 Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma X$ ;	$C_{2z}, \mathcal{TC}_{2x}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3, \sigma_0$ ;	C-1 WP;	1
$G$ ; $XG$ ;	$C_{2z}, \mathcal{TC}_{2x}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3, \sigma_0$ ;	C-1 WP;	1
$P$ ; $TW$ ;	$C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3$ ;	C-1 WP;	1
$\Sigma$ ; $\Gamma\Sigma/\Gamma X$ ;	$C_{2x}, \mathcal{TC}_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3, \sigma_0$ ;	C-1 WP;	1
$F$ ; $XF$ ;	$C_{2x}, \mathcal{TC}_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3, \sigma_0$ ;	C-1 WP;	1
$D$ ; $SW$ ;	$C_{2x}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3$ ;	C-1 WP;	1
$\Delta$ ; $\Gamma\Delta/\Gamma X$ ;	$C_{2y}, \mathcal{TC}_{2x}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3, \sigma_0$ ;	C-1 WP;	1
$U$ ; $XU$ ;	$C_{2y}, \mathcal{TC}_{2x}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3, \sigma_0$ ;	C-1 WP;	1
$Q$ ; $RW$ ;	$C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3$ ;	C-1 WP;	1

## SG 24

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 Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma X$ ;	$C_{2z}, \mathcal{TC}_{2x}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3, \sigma_0$ ;	C-1 WP;	1
$G$ ; $XG$ ;	$C_{2z}, \mathcal{TC}_{2x}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$-\sigma_3, \sigma_0$ ;	C-1 WP;	1
$P$ ; $TW$ ;	$C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	2;	$\sigma_3$ ;	C-1 WP;	1
$\Sigma$ ; $\Gamma\Sigma/\Gamma X$ ;	$C_{2x}, \mathcal{TC}_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3, \sigma_0$ ;	C-1 WP;	1
$F$ ; $XF$ ;	$C_{2x}, \mathcal{TC}_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$-\sigma_3, \sigma_0$ ;	C-1 WP;	1
$D$ ; $SW$ ;	$C_{2x}$ ;	$\{R_2\}, \{R_4\}$ ;	2;	$-\sigma_3$ ;	C-1 WP;	1
$\Delta$ ; $\Gamma\Delta/\Gamma X$ ;	$C_{2y}, \mathcal{TC}_{2x}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3, \sigma_0$ ;	C-1 WP;	1
$U$ ; $XU$ ;	$C_{2y}, \mathcal{TC}_{2x}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3, \sigma_0$ ;	C-1 WP;	1
$Q$ ; $RW$ ;	$C_{2y}$ ;	$\{R_2\}, \{R_4\}$ ;	2;	$\sigma_3$ ;	C-1 WP;	1

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$D$ ; $XS$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$P$ ; $UR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$B$ ; $ZT$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$C$ ; $YS$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$E$ ; $TR$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$A$ ; $ZU$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$Q$ ; $SR$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$G$ ; $XU$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;



## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;	
$D$ ; $XS$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;	
$P$ ; $UR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1, R_1\}, \{R_2, R_2\}$ ;	4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	DP;	0
$B$ ; $ZT$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1, R_1\}, \{R_2, R_2\}$ ;	4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	DP;	0
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;	
$C$ ; $YS$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;	
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$Q$ ; $SR$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$G$ ; $XU$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$D$ ; $XS$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$C$ ; $YS$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;	
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
YT; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;	
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$H$ ;	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$Q$ ; SR; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;	
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$G$ ; XU; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;	
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;

SG 28

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$D$ ; $XS$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$P$ ; $UR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$B$ ; $ZT$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$A$ ; $ZU$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$G$ ; $XU$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;

SG 29

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$D$ ; $XS$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$P$ ; $UR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1, R_1\}, \{R_2, R_2\}$ ; 4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$B$ ; $ZT$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1, R_1\}, \{R_2, R_2\}$ ; 4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$E$ ; $TR$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1, R_1\}, \{R_2, R_2\}$ ; 4; $-i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$G$ ; $XU$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$D$ ; $XS$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$E$ ; $TR$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$G$ ; $XU$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;

## 5. SG 31-40

SG 31

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$D$ ; $XS$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$A$ ; $ZU$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1, R_1\}, \{R_2, R_2\}$ ;	4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;
$G$ ; $XU$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;

SG 32

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$B$ ; $ZT$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$A$ ; $ZU$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$Q$ ; $SR$ ; $C_{2z}, \sigma_y, E$ ; $\{R_5\}, \{R_6\}$ ; 2; $\sigma_3, -i\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_5\}, \{R_7\}$ ; 2; $\sigma_0, -i\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_5\}, \{R_8\}$ ; 2; $\sigma_3, -i\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_6\}, \{R_7\}$ ; 2; $-\sigma_3, -i\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_6\}, \{R_8\}$ ; 2; $-\sigma_0, -i\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_7\}, \{R_8\}$ ; 2; $\sigma_3, i\sigma_0, \sigma_0$ ;	P-WNL;

## SG 33

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; $2; \sigma_3, \sigma_0$ ; P-WNL;
$B$ ; $ZT$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1, R_1\}, \{R_2, R_2\}$ ; $4; \Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP;
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; $2; \sigma_3, \sigma_0$ ; P-WNL;
$E$ ; $TR$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1, R_1\}, \{R_2, R_2\}$ ; $4; -i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; $2; \sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; $2; \sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; $2; \sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; $2; \sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; $2; \sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; $2; -\sigma_0, \sigma_3$ ; P-WNLs;
$Q$ ; $SR$ ; $C_{2z}, \sigma_y, E$ ; $\{R_5\}, \{R_6\}$ ; $2; \sigma_3, -i\sigma_0, \sigma_0$ ; P-WNL;
$\{R_5\}, \{R_7\}$ ; $2; \sigma_0, -i\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_5\}, \{R_8\}$ ; $2; \sigma_3, -i\sigma_3, \sigma_0$ ; P-WNL;
$\{R_6\}, \{R_7\}$ ; $2; -\sigma_3, -i\sigma_3, \sigma_0$ ; P-WNL;
$\{R_6\}, \{R_8\}$ ; $2; -\sigma_0, -i\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_7\}, \{R_8\}$ ; $2; \sigma_3, i\sigma_0, \sigma_0$ ; P-WNL;

## SG 34

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; $2; \sigma_3, \sigma_0$ ; P-WNL;
$P$ ; $UR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; $2; -i\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; $2; \sigma_3, \sigma_0$ ; P-WNL;
$E$ ; $TR$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; $2; -i\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; $2; \sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; $2; \sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; $2; \sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; $2; \sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; $2; \sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; $2; -\sigma_0, \sigma_3$ ; P-WNLs;
$Q$ ; $SR$ ; $C_{2z}, \sigma_y, E$ ; $\{R_5\}, \{R_6\}$ ; $2; \sigma_3, -i\sigma_0, \sigma_0$ ; P-WNL;
$\{R_5\}, \{R_7\}$ ; $2; \sigma_0, -i\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_5\}, \{R_8\}$ ; $2; \sigma_3, -i\sigma_3, \sigma_0$ ; P-WNL;
$\{R_6\}, \{R_7\}$ ; $2; -\sigma_3, -i\sigma_3, \sigma_0$ ; P-WNL;
$\{R_6\}, \{R_8\}$ ; $2; -\sigma_0, -i\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_7\}, \{R_8\}$ ; $2; \sigma_3, i\sigma_0, \sigma_0$ ; P-WNL;

$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3;$	P-WNLs;
	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3;$	P-WNLs;
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3;$	P-WNLs;
$D$ ; $SR$ ; $C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3;$	C-1 WP; 1
$A$ ; $ZT$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$\Sigma$ ; $\Gamma Y$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$\Delta$ ; $\Gamma \Delta$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$B$ ; $ZB$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$G$ ; $TG$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$F$ ; $YF$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$E$ ; $TE$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$C$ ; $YC$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;

## SG 36

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$D$ ; $SR$ ; $C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3$ ;	C-1 WP; 1
$A$ ; $ZT$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1, R_1\}, \{R_2, R_2\}$ ;	4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	DP; 0
$\Sigma$ ; $\Gamma Y$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma \Delta$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $YF$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$E$ ; $TE$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1, R_1\}, \{R_2, R_2\}$ ;	4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	DP; 0
$C$ ; $YC$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;

## SG 37

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$D$ ; $SR$ ; $C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma Y$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma \Delta$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $YF$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$C$ ; $YC$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;



## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $\sigma_x, \mathcal{T}\sigma_z$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$H$ ; $YT$ ; $\sigma_x, \mathcal{T}\sigma_z$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$A$ ; $ZT$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$\Sigma$ ; $\Gamma Y$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$\Delta$ ; $\Gamma\Delta$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;	
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;	
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;	
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;	
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;	
$B$ ; $ZB$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;	
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;	
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;	
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;	
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;	
$G$ ; $TG$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;	
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;	
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;	
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;	
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;	
$F$ ; $YF$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;	
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;	
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;	
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;	
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;	
$E$ ; $TE$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$C$ ; $YC$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $\sigma_x, \mathcal{T}\sigma_z$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$H$ ; $YT$ ; $\sigma_x, \mathcal{T}\sigma_z$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_3, \sigma_0$ ; P-WNL;
$A$ ; $ZT$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma Y$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Delta$ ; $\Gamma\Delta$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$B$ ; $ZB$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$G$ ; $TG$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, -\sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, -\sigma_3$ ; P-WNLs;
$F$ ; $YF$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, -\sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, -\sigma_3$ ; P-WNLs;
$E$ ; $TE$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$C$ ; $YC$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;

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 Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $\sigma_x, \mathcal{T}\sigma_z$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$H$ ; $YT$ ; $\sigma_x, \mathcal{T}\sigma_z$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma Y$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Delta$ ; $\Gamma \Delta$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$F$ ; $YF$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$C$ ; $YC$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;

SG 41

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $\sigma_x, \mathcal{T}\sigma_z$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$H$ ; $YT$ ; $\sigma_x, \mathcal{T}\sigma_z$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Sigma$ ; $\Gamma Y$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma \Delta$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$F$ ; $YF$ ; $C_{2y}, \sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, -\sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, -\sigma_3$ ;	P-WNLs;
$C$ ; $YC$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z/\Gamma\Lambda$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$G$ ; $XG/XY$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$H$ ; $YH/YX$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$Q$ ; $ZQ$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ; P-WNLs;
$\Sigma$ ; $\Gamma X/\Gamma\Sigma$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$C$ ; $YC/YZ$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$A$ ; $ZA/ZY$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$U$ ; $XU$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$\Delta$ ; $\Gamma Y/\Gamma\Delta$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$D$ ; $XD/XZ$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$B$ ; $ZB/ZX$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
	$R$ ; $YR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;

SG 43

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z/\Gamma\Lambda$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;	
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;	
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;	
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;	
$Q$ ; $ZQ$ ;	$C_{2z}, \sigma_y, E$ ; $\{R_5\}, \{R_6\}$ ; 2; $\sigma_3, -i\sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_5\}, \{R_7\}$ ; 2; $\sigma_0, -i\sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_5\}, \{R_8\}$ ; 2; $\sigma_3, -i\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_6\}, \{R_7\}$ ; 2; $-\sigma_3, -i\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_6\}, \{R_8\}$ ; 2; $-\sigma_0, -i\sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_7\}, \{R_8\}$ ; 2; $\sigma_3, i\sigma_0, \sigma_0$ ;	P-WNL;	
$\Sigma$ ; $\Gamma X/\Gamma\Sigma$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;	
$U$ ; $XU$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma Y/\Gamma\Delta$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;	
$R$ ; $YR$ ;	$\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3, \sigma_0$ ;	P-WNL;

SG 44

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma X$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;		
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;		
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;		
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;		
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;		
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;		
$G$ ; $XG$ ;	$C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;	
		$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;	
		$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;	
		$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;	
		$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;	
		$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;	
$P$ ; $TW$ ;	$C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1	
$\Sigma$ ; $\Gamma\Sigma/\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;		
$F$ ; $XF$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;	
$\Delta$ ; $\Gamma\Delta/\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;		
$U$ ; $XU$ ;	$\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;	

## SG 45

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma X$ ;	$C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$G$ ; $XG$ ;	$C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$P$ ; $TW$ ;	$C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma\Sigma/\Gamma X$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $XF$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma\Delta/\Gamma X$ ;	$\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; $XU$ ;	$\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;

## SG 46

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma X$ ;	$C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$G$ ; $XG$ ;	$C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$P$ ; $TW$ ;	$C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma\Sigma/\Gamma X$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $XF$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma\Delta/\Gamma X$ ;	$\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; $XU$ ;	$\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;

$\Delta$ ; $\Gamma Y$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$D$ ; $XS$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$P$ ; $UR$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$B$ ; $ZT$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Sigma$ ; $\Gamma X$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$C$ ; $YS$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$E$ ; $TR$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;



- $A$ ; ZU;  $C_{2x,\sigma_z,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z,\sigma_y,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $H$ ; YT;  $C_{2z,\sigma_y,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $Q$ ; SR;  $C_{2z,\sigma_y,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $G$ ; XU;  $C_{2z,\sigma_y,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
$P$ ; $UR$ ; $\sigma_z, C_{2y}, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_6\}$ ; 2; $-i\sigma_0, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_4\}, \{R_6\}$ ; 2; $i\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_4\}, \{R_8\}$ ; 2; $i\sigma_0, \sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma X$ ; $C_{2x}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
$E$ ; $TR$ ; $\sigma_z, C_{2x}, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_6\}$ ; 2; $i\sigma_0, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_4\}, \{R_6\}$ ; 2; $-i\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_4\}, \{R_8\}$ ; 2; $-i\sigma_0, \sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
$Q$ ; $SR$ ; $\sigma_x, C_{2z}, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_6\}$ ; 2; $i\sigma_0, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_4\}, \{R_6\}$ ; 2; $-i\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_4\}, \{R_8\}$ ; 2; $-i\sigma_0, \sigma_3, \sigma_0$ ; P-WNL;

$\Delta$ ; $\Gamma Y$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$D$ ; $XS$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Sigma$ ; $\Gamma X$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$C$ ; $YS$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$H$ ; $YT$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$Q$ ; $SR$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

$G$ ; XU;  $C_{2z,\sigma_y,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$B$ ; $ZT$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Sigma$ ; $\Gamma X$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$A$ ; $ZU$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$Q$ ; $SR$ ; $\sigma_y, C_{2z}, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_6\}$ ; 2; $i\sigma_0, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_4\}, \{R_6\}$ ; 2; $-i\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_4\}, \{R_8\}$ ; 2; $-i\sigma_0, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -\sigma_0, \sigma_0$ ; P-WNLs;

SG 51

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$D$ ; $XS$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma X$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$C$ ; $YS$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$E$ ; $TR$ ; $C_{2x, \sigma_y, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$A$ ; $ZU$ ; $C_{2x, \sigma_y, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$H$ ; $YT$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$Q$ ; $SR$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

$G$ ; XU;  $C_{2z}, \sigma_y, IT$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

SG 52

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$P$ ; UR; $\sigma_z, C_{2y}, IT$ ; $\{R_2, R_8\}, \{R_4, R_6\}$ ;	4; $-i\Gamma_{3,3}, \Gamma_{0,3}, \Gamma_{0,1}$ ;	DP; 0
$\Sigma$ ; $\Gamma X$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$A$ ; ZU; $C_{2x}, \sigma_y, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$Q$ ; SR; $\sigma_y, C_{2z}, IT$ ; $\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_6\}$ ;	2; $i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_8\}$ ;	2; $i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_4\}, \{R_6\}$ ;	2; $-i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_4\}, \{R_8\}$ ;	2; $-i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_6\}, \{R_8\}$ ;	2; $i\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$D$ ; $XS$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma X$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$A$ ; $ZU$ ; $C_{2x, \sigma_y, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ; 4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ; DP; 0			
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$G$ ; $XU$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;



## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$P$ ; $UR$ ; $\sigma_x, C_{2y}, IT$ ; $\{R_2, R_6\}, \{R_4, R_8\}$ ; 4; $-i\Gamma_{3,0}, \Gamma_{0,3}, \Gamma_{0,1}$ ; DP; 0			
$\Sigma$ ; $\Gamma X$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$C$ ; $YS$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$E$ ; $TR$ ; $C_{2x}, \sigma_y, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ; 4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ; DP; 0			
$A$ ; $ZU$ ; $C_{2x}, \sigma_y, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ; 4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ; DP; 0			
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$H$ ; $YT$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$D$ ; $XS$ ; $C_{2y, \sigma_z, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$P$ ; $UR$ ; $C_{2y, \sigma_z, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$B$ ; $ZT$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma X$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$C$ ; $YS$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $-\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$E$ ; $TR$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $-\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$A$ ; $ZU$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$Q$ ; $SR$ ; $\sigma_y, C_{2z, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $i\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$P$ ; $UR$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_2, R_8\}, \{R_4, R_6\}$ ;	4; $\Gamma_{3,3}, -i\Gamma_{0,3}, \Gamma_{0,1}$ ;	DP; 0
$\Sigma$ ; $\Gamma X$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$E$ ; $TR$ ; $C_{2x, \sigma_y, IT}$ ; $\{R_2, R_8\}, \{R_4, R_6\}$ ;	4; $-\Gamma_{3,3}, -i\Gamma_{0,3}, \Gamma_{0,1}$ ;	DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$H$ ; $YT$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1, R_4\}, \{R_2, R_3\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,3}, \Gamma_{0,1}$ ;	DP; 0
$Q$ ; $SR$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1, R_2\}, \{R_3, R_4\}$ ;	4; $\Gamma_{3,0}, \Gamma_{0,3}, \Gamma_{0,1}$ ;	DP; 0
$G$ ; $XU$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1, R_3\}, \{R_2, R_4\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$B$ ; $ZT$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma X$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$C$ ; $YS$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $-\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$E$ ; $TR$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $-\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$A$ ; $ZU$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$G$ ; $XU$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1, R_3\}, \{R_2, R_4\}$ ;	$\{R_1, R_3\}, \{R_2, R_4\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$D$ ; $XS$ ; $C_{2y}, \sigma_z, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$\Sigma$ ; $\Gamma X$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$C$ ; $YS$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $-\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$Q$ ; $SR$ ; $\sigma_y, C_{2z}, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $i\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$B$ ; $ZT$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma X$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$A$ ; $ZU$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$H$ ; $YT$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1, R_4\}, \{R_2, R_3\}$ ;	$\{R_1, R_4\}, \{R_2, R_3\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,3}, \Gamma_{0,1}$ ;	DP; 0
$Q$ ; $SR$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1, R_2\}, \{R_3, R_4\}$ ;	$\{R_1, R_2\}, \{R_3, R_4\}$ ;	4; $\Gamma_{3,0}, \Gamma_{0,3}, \Gamma_{0,1}$ ;	DP; 0
$G$ ; $XU$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1, R_3\}, \{R_2, R_4\}$ ;	$\{R_1, R_3\}, \{R_2, R_4\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$D$ ; $XS$ ; $C_{2y, \sigma_z, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ; 4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;		DP; 0
$\Sigma$ ; $\Gamma X$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$C$ ; $YS$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_5\}, \{R_5\}$ ;	4; $-\Gamma_{0,2}, i\Gamma_{0,3}, -i\Gamma_{0,3}$ ;	DP; 0
$E$ ; $TR$ ; $C_{2x, \sigma_y, IT}$ ; $\{R_2, R_8\}, \{R_4, R_6\}$ ; 4; $-\Gamma_{3,3}, -i\Gamma_{0,3}, \Gamma_{0,1}$ ;		DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$H$ ; $YT$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1, R_4\}, \{R_2, R_3\}$ ; 4; $\Gamma_{0,3}, \Gamma_{3,3}, \Gamma_{0,1}$ ;		DP; 0

SG 61

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$D$ ; $XS$ ; $C_{2y, \sigma_z, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$\Sigma$ ; $\Gamma X$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$A$ ; $ZU$ ; $C_{2x, \sigma_y, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$H$ ; $YT$ ; $C_{2z, \sigma_x, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $-\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0



## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$P$ ; $UR$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_2, R_6\}, \{R_4, R_8\}$ ; 4; $\Gamma_{3,0}, -i\Gamma_{0,3}, \Gamma_{0,1}$ ;	DP;	0
$\Sigma$ ; $\Gamma X$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$C$ ; $YS$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1, R_3\}, \{R_2, R_4\}$ ; 4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP;	0
$E$ ; $TR$ ; $C_{2x, \sigma_y, IT}$ ; $\{R_2, R_6\}, \{R_4, R_8\}$ ; 4; $\Gamma_{3,0}, \Gamma_{0,3}, \Gamma_{0,1}$ ;	DP;	0
$A$ ; $ZU$ ; $C_{2x, \sigma_y, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ; 4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP;	0
$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$G$ ; $XU$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1, R_3\}, \{R_2, R_4\}$ ; 4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP;	0

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$H$ ; $YT$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$D$ ; $SR$ ; $C_{2z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Sigma$ ; $\Gamma Y$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Delta$ ; $\Gamma \Delta$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$B$ ; $ZB$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$G$ ; $TG$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$F$ ; $YF$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$C$ ; $YC$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$H$ ; $YT$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma Y$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Delta$ ; $\Gamma \Delta$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$B$ ; $ZB$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$G$ ; $TG$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, -\Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$F$ ; $YF$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$C$ ; $YC$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$H$ ; $YT$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$D$ ; $SR$ ; $C_{2z}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$A$ ; $ZT$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Sigma$ ; $\Gamma Y$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Delta$ ; $\Gamma \Delta$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$B$ ; $ZB$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$G$ ; $TG$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

$F$ ; YF;  $C_{2y, \sigma_x, I\mathcal{T}}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $E$ ; TE;  $C_{2x, \sigma_z, I\mathcal{T}}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $C$ ; YC;  $C_{2x, \sigma_z, I\mathcal{T}}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$H$ ; $YT$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$D$ ; $SR$ ; $C_{2z}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$\Sigma$ ; $\Gamma Y$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Delta$ ; $\Gamma \Delta$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$F$ ; $YF$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$C$ ; $YC$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$H$ ; $YT$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, -\sigma_3, \sigma_0$ ; P-WNLs;
$A$ ; $ZT$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Sigma$ ; $\Gamma Y$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Delta$ ; $\Gamma \Delta$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$B$ ; $ZB$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$G$ ; $TG$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

$F$ ; YF;  $C_{2y,\sigma_x,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $E$ ; TE;  $C_{2x,\sigma_z,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $C$ ; YC;  $C_{2x,\sigma_z,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;



## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$H$ ; $YT$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, -\sigma_3, \sigma_0$ ; P-WNLs;
$\Sigma$ ; $\Gamma Y$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Delta$ ; $\Gamma \Delta$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$F$ ; $YF$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$C$ ; $YC$ ; $C_{2x, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z/\Gamma\Lambda$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$G$ ; $XG/XY$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$H$ ; $YH/YX$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$Q$ ; $ZQ$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Sigma$ ; $\Gamma X/\Gamma\Sigma$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$C$ ; $YC/YZ$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$A$ ; $ZA/ZY$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

$U$ ; XU;	$C_{2x,\sigma_z,IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
		$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
		$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
		$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
		$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\Delta$ ; $\Gamma Y/\Gamma \Delta$ ; $C_{2y,\sigma_x,IT}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
		$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
		$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
		$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
		$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$D$ ; XD/XZ; $C_{2y,\sigma_x,IT}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
		$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
		$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
		$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
		$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$B$ ; ZB/ZX; $C_{2y,\sigma_x,IT}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
		$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
		$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
		$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
		$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$R$ ; YR; $C_{2y,\sigma_x,IT}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
		$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;
		$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;
		$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;
		$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z/\Gamma\Lambda$ ; $C_{2z}, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$Q$ ; $ZQ$ ; $\sigma_x, C_{2z}, IT$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_6\}$ ; 2; $i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_6\}$ ; 2; $-i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_8\}$ ; 2; $-i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma X/\Gamma\Sigma$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $XU$ ; $\sigma_y, C_{2x}, IT$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_6\}$ ; 2; $i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_6\}$ ; 2; $-i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_8\}$ ; 2; $-i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
$\Delta$ ; $\Gamma Y/\Gamma\Delta$ ; $C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$R$ ; $YR$ ; $\sigma_x, C_{2y}, IT$ ;	$\{R_2\}, \{R_4\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_6\}$ ; 2; $-i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_6\}$ ; 2; $i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_8\}$ ; 2; $i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;

SG 71

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma X$ ;	$C_{2z}, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$G$ ; $XG$ ;	$C_{2z}, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$P$ ; $TW$ ;	$C_{2z}, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Sigma$ ; $\Gamma\Sigma/\Gamma X$ ;	$C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$F$ ; $XF$ ;	$C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$D$ ; $SW$ ;	$C_{2x}, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma\Delta/\Gamma X$ ;	$C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $XU$ ;	$C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$Q$ ; $RW$ ;	$C_{2y}, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;

$\Lambda$ ; $\Gamma\Lambda/\Gamma X$ ;	$C_{2z}, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2;	$\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2;	$\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2;	$\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2;	$\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2;	$-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$G$ ; $XG$ ;	$C_{2z}, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2;	$\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2;	$\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2;	$\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2;	$\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2;	$-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$P$ ; $TW$ ;	$C_{2z}, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_3, \sigma_0$ ;	P-WNL;
$\Sigma$ ; $\Gamma\Sigma/\Gamma X$ ;	$C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2;	$\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2;	$\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2;	$\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2;	$\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2;	$-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$F$ ; $XF$ ;	$C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2;	$\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2;	$\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2;	$\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2;	$\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2;	$-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Delta$ ; $\Gamma\Delta/\Gamma X$ ;	$C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2;	$\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2;	$\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2;	$\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2;	$\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2;	$-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $XU$ ;	$C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2;	$\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2;	$\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2;	$\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2;	$\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2;	$-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma X$ ; $C_{2z}, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$G$ ; $XG$ ; $C_{2z}, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}; 2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; -\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; -\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; -\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; -\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma\Sigma/\Gamma X$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$F$ ; $XF$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}; 2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; -\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; -\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; -\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; -\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Delta$ ; $\Gamma\Delta/\Gamma X$ ; $C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $XU$ ; $C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

$\Lambda$ ; $\Gamma\Lambda/\Gamma X$ ;	$C_{2z}, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$G$ ; $XG$ ;	$C_{2z}, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}; 2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; -\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}; 2; -\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}; 2; -\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}; 2; -\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}; 2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma\Sigma/\Gamma X$ ;	$C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$F$ ; $XF$ ;	$C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}; 2; -\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; -\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}; 2; -\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}; 2; -\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}; 2; -\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}; 2; \sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
$D$ ; $SW$ ;	$C_{2x}, IT$ ;	$\{R_2\}, \{R_4\}; 2; -\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma\Delta/\Gamma X$ ;	$C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $XU$ ;	$C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}; 2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}; 2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}; 2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}; 2; -\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
$Q$ ; $RW$ ;	$C_{2y}, IT$ ;	$\{R_2\}, \{R_4\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;



SG 75

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3$ ; C-2 WP; 2	
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3)$ ; C-1 WP; 1	
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-2 WP; 2	
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$V$ ; $MA$ ; $C_{4z}^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3$ ; C-2 WP; 2	
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3)$ ; C-1 WP; 1	
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-2 WP; 2	
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$W$ ; $XR$ ; $C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; C-1 WP; 1	

SG 76

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3$ ; C-2 WP; 2	
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3)$ ; C-1 WP; 1	
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-2 WP; 2	
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$V$ ; $MA$ ; $C_{4z}^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3$ ; C-2 WP; 2	
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3)$ ; C-1 WP; 1	
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-2 WP; 2	
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3)$ ; C-1 WP; 1	
$W$ ; $XR$ ; $C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; C-1 WP; 1	

SG 77

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+$	$\{R_1\}, \{R_2\}; 2; (\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_1\}, \{R_3\}; 2; \sigma_3;$	C-2 WP; 2
	$\{R_1\}, \{R_4\}; 2; (\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3);$	C-1 WP; 1
	$\{R_2\}, \{R_3\}; 2; (-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_2\}, \{R_4\}; 2; i\sigma_3;$	C-2 WP; 2
	$\{R_3\}, \{R_4\}; 2; (-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_1\}, \{R_2\}; 2; (\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_1\}, \{R_3\}; 2; \sigma_3;$	C-2 WP; 2
	$\{R_1\}, \{R_4\}; 2; (\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3);$	C-1 WP; 1
	$\{R_2\}, \{R_3\}; 2; (-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+$	$\{R_2\}, \{R_4\}; 2; i\sigma_3;$	C-2 WP; 2
	$\{R_3\}, \{R_4\}; 2; (-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_1\}, \{R_2\}; 2; (\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_1\}, \{R_3\}; 2; \sigma_3;$	C-2 WP; 2
$W$ ; $XR$ ; $C_{2z}$	$\{R_1\}, \{R_2\}; 2; \sigma_3;$	C-1 WP; 1

SG 78

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+$	$\{R_1\}, \{R_2\}; 2; (\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_1\}, \{R_3\}; 2; \sigma_3;$	C-2 WP; 2
	$\{R_1\}, \{R_4\}; 2; (\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3);$	C-1 WP; 1
	$\{R_2\}, \{R_3\}; 2; (-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_2\}, \{R_4\}; 2; i\sigma_3;$	C-2 WP; 2
	$\{R_3\}, \{R_4\}; 2; (-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_1\}, \{R_2\}; 2; (\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_1\}, \{R_3\}; 2; \sigma_3;$	C-2 WP; 2
	$\{R_1\}, \{R_4\}; 2; (\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3);$	C-1 WP; 1
	$\{R_2\}, \{R_3\}; 2; (-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+$	$\{R_2\}, \{R_4\}; 2; i\sigma_3;$	C-2 WP; 2
	$\{R_3\}, \{R_4\}; 2; (-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_1\}, \{R_2\}; 2; (\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
	$\{R_1\}, \{R_3\}; 2; \sigma_3;$	C-2 WP; 2
$W$ ; $XR$ ; $C_{2z}$	$\{R_1\}, \{R_2\}; 2; \sigma_3;$	C-1 WP; 1

## SG 79

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 Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+$ ;	$\{R_1\}, \{R_2\}; 2; (\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
		$\{R_1\}, \{R_3\}; 2; \sigma_3;$	C-2 WP; 2
		$\{R_1\}, \{R_4\}; 2; (\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3);$	C-1 WP; 1
		$\{R_2\}, \{R_3\}; 2; (-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
		$\{R_2\}, \{R_4\}; 2; i\sigma_3;$	C-2 WP; 2
		$\{R_3\}, \{R_4\}; 2; (-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
$V$ ; $ZV$ ;	$C_{4z}^+$ ;	$\{R_1\}, \{R_2\}; 2; (\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
		$\{R_1\}, \{R_3\}; 2; \sigma_3;$	C-2 WP; 2
		$\{R_1\}, \{R_4\}; 2; (\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3);$	C-1 WP; 1
		$\{R_2\}, \{R_3\}; 2; (-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
		$\{R_2\}, \{R_4\}; 2; i\sigma_3;$	C-2 WP; 2
		$\{R_3\}, \{R_4\}; 2; (-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
$W$ ; $XP$ ;	$C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3;$	C-1 WP; 1

## SG 80

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 Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+$ ;	$\{R_1\}, \{R_2\}; 2; (\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
		$\{R_1\}, \{R_3\}; 2; \sigma_3;$	C-2 WP; 2
		$\{R_1\}, \{R_4\}; 2; (\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3);$	C-1 WP; 1
		$\{R_2\}, \{R_3\}; 2; (-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
		$\{R_2\}, \{R_4\}; 2; i\sigma_3;$	C-2 WP; 2
		$\{R_3\}, \{R_4\}; 2; (-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
$V$ ; $ZV$ ;	$C_{4z}^+$ ;	$\{R_1\}, \{R_2\}; 2; (\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
		$\{R_1\}, \{R_3\}; 2; \sigma_3;$	C-2 WP; 2
		$\{R_1\}, \{R_4\}; 2; (\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3);$	C-1 WP; 1
		$\{R_2\}, \{R_3\}; 2; (-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
		$\{R_2\}, \{R_4\}; 2; i\sigma_3;$	C-2 WP; 2
		$\{R_3\}, \{R_4\}; 2; (-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3);$	C-1 WP; 1
$W$ ; $XP$ ;	$C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3;$	C-1 WP; 1

## SG 81

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, S_{4z}^+ \mathcal{T}$ ;  $\{R_1\}, \{R_2, R_2\}$ ; 3;  $A_{13}, A_{19}$ ; TP;  
 $V$ ; MA;  $C_{2z}, S_{4z}^+ \mathcal{T}$ ;  $\{R_1\}, \{R_2, R_2\}$ ; 3;  $A_{13}, A_{19}$ ; TP;  
 $W$ ; XR;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1

## SG 82

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma \Lambda / \Gamma Z$ ;  $C_{2z}, S_{4z}^+ \mathcal{T}$ ;  $\{R_1\}, \{R_2, R_2\}$ ; 3;  $A_{13}, A_{19}$ ; TP;  
 $V$ ; ZV;  $C_{2z}, S_{4z}^+ \mathcal{T}$ ;  $\{R_1\}, \{R_2, R_2\}$ ; 3;  $A_{13}, A_{19}$ ; TP;  
 $W$ ; XP;  $C_{2z}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1

## SG 83

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma X$ ;  $\sigma_z, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $U$ ; ZR;  $\sigma_z, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{4z}^+, I\mathcal{T}$ ;  $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_2, R_4\}$ ; 3;  $A_{26}, A_{17}$ ; TP;  
 $\{R_2, R_4\}, \{R_3\}$ ; 3;  $A_{27}, A_{20}$ ; TP;  
 $V$ ; MA;  $C_{4z}^+, I\mathcal{T}$ ;  $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_2, R_4\}$ ; 3;  $A_{26}, A_{17}$ ; TP;  
 $\{R_2, R_4\}, \{R_3\}$ ; 3;  $A_{27}, A_{20}$ ; TP;  
 $\Sigma$ ;  $\Gamma M$ ;  $\sigma_z, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $S$ ; ZA;  $\sigma_z, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $Y$ ; XM;  $\sigma_z, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $T$ ; RA;  $\sigma_z, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;  
 $W$ ; XR;  $C_{2z}, I\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3, \sigma_0$ ; P-WNL;

SG 84

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$U$ ; $ZR$ ; $\sigma_z, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, IT$ ; $\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_2, R_4\}$ ; 3; $A_{26}, A_{17}$ ; TP;
$\{R_2, R_4\}, \{R_3\}$ ; 3; $A_{27}, A_{20}$ ; TP;
$V$ ; $MA$ ; $C_{4z}^+, IT$ ; $\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_2, R_4\}$ ; 3; $A_{26}, A_{17}$ ; TP;
$\{R_2, R_4\}, \{R_3\}$ ; 3; $A_{27}, A_{20}$ ; TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$S$ ; $ZA$ ; $\sigma_z, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$Y$ ; $XM$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$T$ ; $RA$ ; $\sigma_z, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$W$ ; $XR$ ; $C_{2z}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;

SG 85

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$U$ ; $ZR$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, IT$ ; $\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_2, R_4\}$ ; 3; $A_{26}, A_{17}$ ; TP;
$\{R_2, R_4\}, \{R_3\}$ ; 3; $A_{27}, A_{20}$ ; TP;
$V$ ; $MA$ ; $C_{4z}^+, E, IT$ ; $\{R_5, R_7\}, \{R_6\}$ ; 3; $iA_{27}, A_0, A_{20}$ ; TP;
$\{R_5, R_7\}, \{R_8\}$ ; 3; $A_{28}, A_0, A_{20}$ ; TP;
$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0$ ; P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$S$ ; $ZA$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$Y$ ; $XM$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3, \sigma_0$ ; P-WNL;
$T$ ; $RA$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3, \sigma_0$ ; P-WNL;

SG 86

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$U$ ; $ZR$ ; $\sigma_z, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, IT$ ; $\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_2, R_4\}$ ; 3; $A_{26}, A_{17}$ ; TP;
$\{R_2, R_4\}, \{R_3\}$ ; 3; $A_{27}, A_{20}$ ; TP;
$V$ ; $MA$ ; $C_{4z}^+, E, IT$ ; $\{R_5, R_7\}, \{R_6\}$ ; 3; $iA_{27}, A_0, A_{20}$ ; TP;
$\{R_5, R_7\}, \{R_8\}$ ; 3; $A_{28}, A_0, A_{20}$ ; TP;
$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0$ ; P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$S$ ; $ZA$ ; $\sigma_z, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$Y$ ; $XM$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3, \sigma_0$ ; P-WNL;
$T$ ; $RA$ ; $\sigma_z, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $-i\sigma_3, \sigma_0$ ; P-WNL;

SG 87

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, IT$ ; $\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_2, R_4\}$ ; 3; $A_{26}, A_{17}$ ; TP;
$\{R_2, R_4\}, \{R_3\}$ ; 3; $A_{27}, A_{20}$ ; TP;
$V$ ; $ZV$ ; $C_{4z}^+, IT$ ; $\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_2, R_4\}$ ; 3; $A_{26}, A_{17}$ ; TP;
$\{R_2, R_4\}, \{R_3\}$ ; 3; $A_{27}, A_{20}$ ; TP;
$W$ ; $XP$ ; $C_{2z}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$F$ ; $ZF$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Delta$ ; $\Gamma X$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$U$ ; $ZU$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$Y$ ; $XZ/XY$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;

SG 88

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, IT$ ; $\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_2, R_4\}$ ; 3; $A_{26}, A_{17}$ ; TP;
$\{R_2, R_4\}, \{R_3\}$ ; 3; $A_{27}, A_{20}$ ; TP;
$V$ ; $ZV$ ; $C_{4z}^+, E, IT$ ; $\{R_5, R_7\}, \{R_6\}$ ; 3; $-iA_{27}, A_0, A_{20}$ ; P-WNLs;
$\{R_5, R_7\}, \{R_8\}$ ; 3; $-A_{28}, A_0, A_{20}$ ; TP;
$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ; TP;
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$F$ ; $ZF$ ; $\sigma_z, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Delta$ ; $\Gamma X$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$U$ ; $ZU$ ; $\sigma_z, IT$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$Y$ ; $XZ/XY$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3, \sigma_0$ ; P-WNL;

SG 89

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$U$ ; $ZR$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ; C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ; C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ; C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ; C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$S$ ; $ZA$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$Y$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$T$ ; $RA$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$W$ ; $XR$ ; $C_{2z}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ZR$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ;	2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ;	2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ;	2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1, R_3\}, \{R_2, R_4\}$ ;	4; $(\frac{1}{2} + \frac{i}{2})(\Gamma_{0,3} - i\Gamma_{3,3}), \Gamma_{0,1}$ ;	C-2 DP; 2
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S$ ; $ZA$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1



## SG 91

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Y$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$W$ ; $XR$ ; $C_{2z}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

## SG 92

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ;	2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ;	2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ;	2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1, R_3\}, \{R_2, R_4\}$ ; 4; $(\frac{1}{2} + \frac{i}{2})(\Gamma_{0,3} - i\Gamma_{3,3}), \Gamma_{0,1}$ ;		C-2 DP; 2
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T$ ; $RA$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ;		C-2 DP; 2

SG 93

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{TC}_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ZR$ ; $C_{2y}, \mathcal{TC}_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S$ ; $ZA$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Y$ ; $XM$ ; $C_{2x}, \mathcal{TC}_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T$ ; $RA$ ; $C_{2x}, \mathcal{TC}_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$W$ ; $XR$ ; $C_{2z}, \mathcal{TC}_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

SG 94

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ZR$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ;	2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ;	2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ;	2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1, R_3\}, \{R_2, R_4\}$ ; 4; $(\frac{1}{2} + \frac{i}{2})(\Gamma_{0,3} - i\Gamma_{3,3}), \Gamma_{0,1}$ ;		C-2 DP; 2
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S$ ; $ZA$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

SG 95

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Y$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$W$ ; $XR$ ; $C_{2z}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

SG 96

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ;	2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ;	2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ;	2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_1, R_3\}, \{R_2, R_4\}$ ;	4; $(\frac{1}{2} + \frac{i}{2})(\Gamma_{0,3} - i\Gamma_{3,3}), \Gamma_{0,1}$ ;	C-2 DP; 2
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T$ ; $RA$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ;	4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	C-2 DP; 2

SG 97

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
		$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
		$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
		$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$V$ ; $ZV$ ;	$C_{4z}^+, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
		$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
		$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
		$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$W$ ; $XP$ ;	$C_{2z}, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$F$ ; $ZF$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Q$ ; $NP$ ;	$C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1
$\Delta$ ; $\Gamma X$ ;	$C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ZU$ ;	$C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Y$ ; $XZ/XY$ ;	$C_{2b}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

SG 98

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
		$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
		$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
		$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$V$ ; $ZV$ ;	$C_{4z}^+, E, C_{2b}\mathcal{T}$ ;	$\{R_5\}, \{R_6\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0, \sigma_0$ ;	C-1 WP; 1
		$\{R_5\}, \{R_7\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	C-2 WP; 2
		$\{R_5\}, \{R_8\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0, \sigma_0$ ;	C-1 WP; 1
		$\{R_6\}, \{R_7\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0, \sigma_0$ ;	C-1 WP; 1
		$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ;	C-2 WP; 2
		$\{R_7\}, \{R_8\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0, \sigma_0$ ;	C-1 WP; 1
$W$ ; $XP$ ;	$C_{2z}, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$F$ ; $ZF$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Q$ ; $NP$ ;	$C_{2y}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1
$\Delta$ ; $\Gamma X$ ;	$C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ZU$ ;	$C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Y$ ; $XZ/XY$ ;	$C_{2b}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; $ZR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNLs;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}$ ;	TP;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNLs;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}$ ;	TP;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$S$ ; $ZA$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$Y$ ; $XM$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$T$ ; $RA$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$W$ ; $XR$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; $ZR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}$ ;	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, C_{2z}, \sigma_{da}$ ;	$\{R_5\}, \{R_6\}; 2; i\sigma_3, -\sigma_0, -\sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}; 2; i\sigma_3, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_8\}; 2; i\sigma_0, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_9\}; 3; A_{30}, -A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}$ ;	TP;
	$\{R_6\}, \{R_7\}; 2; -i\sigma_0, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}; 2; -i\sigma_3, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}; 3; A_{31}, -A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}$ ;	TP;
	$\{R_7\}, \{R_8\}; 2; -i\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}; 3; A_{31}, -A_{13}, -A_{10}$ ;	TP;
	$\{R_8\}, \{R_9\}; 3; A_{30}, -A_{13}, -A_{10}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$S$ ; $ZA$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;

SG 101

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNLs;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}$ ;	TP;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNLs;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}$ ;	TP;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$S$ ; $ZA$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$Y$ ; $XM$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$W$ ; $XR$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}$ ;	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}$ ;	TP;
$V$ ; MA; $C_{4z}^+, C_{2z}, \sigma_{da}$ ;	$\{R_5\}, \{R_6\}; 2; i\sigma_3, -\sigma_0, -\sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}; 2; i\sigma_3, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_8\}; 2; i\sigma_0, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_9\}; 3; A_{30}, -A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}$ ;	TP;
	$\{R_6\}, \{R_7\}; 2; -i\sigma_0, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}; 2; -i\sigma_3, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}; 3; A_{31}, -A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}$ ;	TP;
	$\{R_7\}, \{R_8\}; 2; -i\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}; 3; A_{31}, -A_{13}, -A_{10}$ ;	TP;
	$\{R_8\}, \{R_9\}; 3; A_{30}, -A_{13}, -A_{10}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$S$ ; ZA; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$T$ ; RA; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}; 2; -i\sigma_3, \sigma_0$ ;	P-WNL;



$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNLs;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}$ ;	TP;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNLs;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}$ ;	TP;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$Y$ ; $XM$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$W$ ; $XR$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}$ ;	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, C_{2z}, \sigma_{da}$ ;	$\{R_5\}, \{R_6\}; 2; i\sigma_3, -\sigma_0, -\sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}; 2; i\sigma_3, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_8\}; 2; i\sigma_0, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_9\}; 3; A_{30}, -A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}$ ;	TP;
	$\{R_6\}, \{R_7\}; 2; -i\sigma_0, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}; 2; -i\sigma_3, -\sigma_0, -\sigma_3$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}; 3; A_{31}, -A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}$ ;	TP;
	$\{R_7\}, \{R_8\}; 2; -i\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}; 3; A_{31}, -A_{13}, -A_{10}$ ;	TP;
	$\{R_8\}, \{R_9\}; 3; A_{30}, -A_{13}, -A_{10}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$T$ ; $RA$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}; 2; -i\sigma_3, \sigma_0$ ;	P-WNL;

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; $ZR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNLs;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}$ ;	TP;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNLs;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}$ ;	TP;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$Y$ ; $XM$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$T$ ; $RA$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$W$ ; $XR$ ; $C_{2z}, \sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta; \Gamma X; \sigma_x, \mathcal{T}C_{2z};$	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$U; ZR; \sigma_x, \mathcal{T}C_{2z};$	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y;$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3;$	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8);$	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3;$	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0;$	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10};$	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3;$	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8);$	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10};$	TP;
$V; MA; C_{4z}^+, C_{2z}, \sigma_{da};$	$\{R_5\}, \{R_6\}; 2; i\sigma_3, -\sigma_0, -\sigma_0;$	P-WNLs;
	$\{R_5\}, \{R_7\}; 2; i\sigma_3, -\sigma_0, -\sigma_3;$	P-WNLs;
	$\{R_5\}, \{R_8\}; 2; i\sigma_0, -\sigma_0, -\sigma_3;$	P-WNLs;
	$\{R_5\}, \{R_9\}; 3; A_{30}, -A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}};$	TP;
	$\{R_6\}, \{R_7\}; 2; -i\sigma_0, -\sigma_0, -\sigma_3;$	P-WNLs;
	$\{R_6\}, \{R_8\}; 2; -i\sigma_3, -\sigma_0, -\sigma_3;$	P-WNLs;
	$\{R_6\}, \{R_9\}; 3; A_{31}, -A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}};$	TP;
	$\{R_7\}, \{R_8\}; 2; -i\sigma_3, -\sigma_0, \sigma_0;$	P-WNLs;
	$\{R_7\}, \{R_9\}; 3; A_{31}, -A_{13}, -A_{10};$	TP;
	$\{R_8\}, \{R_9\}; 3; A_{30}, -A_{13}, -A_{10};$	TP;
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, \sigma_y$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
		$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNLs;
		$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNLs;
		$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}$ ;	TP;
		$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
		$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}$ ;	TP;
$V$ ; $ZV$ ;	$C_{4z}^+, \sigma_y$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
		$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNLs;
		$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNLs;
		$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}$ ;	TP;
		$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
		$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}$ ;	TP;
$W$ ; $XP$ ;	$C_{2z}, \sigma_{db}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
$\Sigma$ ; $\Gamma Z/\Gamma \Sigma$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $ZF$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma X$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; $ZU$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$Y$ ; $XZ/XY$ ;	$\sigma_{da}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, \sigma_y$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
		$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNLs;
		$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNLs;
		$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}$ ;	TP;
		$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
		$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}$ ;	TP;
$V$ ; $ZV$ ;	$C_{4z}^+, \sigma_y$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
		$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNLs;
		$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNLs;
		$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}$ ;	TP;
		$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
		$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}$ ;	TP;
$W$ ; $XP$ ;	$C_{2z}, \sigma_{db}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
$\Sigma$ ; $\Gamma Z/\Gamma \Sigma$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $ZF$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}; 2; -\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma X$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; $ZU$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}; 2; -\sigma_3, \sigma_0$ ;	P-WNL;
$Y$ ; $XZ/XY$ ;	$\sigma_{da}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}$ ;	TP;
$V$ ; $ZV$ ; $C_{4z}^+, C_{2z}, \sigma_y$ ;	$\{R_5\}, \{R_6\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_0, \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_9\}$ ; 3; $A_{30}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_6\}, \{R_7\}$ ; 2; $-i\sigma_0, \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}$ ; 3; $A_{31}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_0, -\sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}$ ; 3; $A_{31}, A_{13}, A_{10}$ ;	TP;
	$\{R_8\}, \{R_9\}$ ; 3; $A_{30}, A_{13}, A_{10}$ ;	TP;
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $ZF$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma X$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}$ ;	TP;
$V$ ; $ZV$ ; $C_{4z}^+, C_{2z}, \sigma_y$ ;	$\{R_5\}, \{R_6\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_0, \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_9\}$ ; 3; $A_{30}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_6\}, \{R_7\}$ ; 2; $-i\sigma_0, \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}$ ; 3; $A_{31}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_0, -\sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}$ ; 3; $A_{31}, A_{13}, A_{10}$ ;	TP;
	$\{R_8\}, \{R_9\}$ ; 3; $A_{30}, A_{13}, A_{10}$ ;	TP;
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $ZF$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_1\}, \{R_2\}$ ; 2; $-\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma X$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;



## 13. SG 111-120

## SG 111

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$U$ ; $ZR$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3, R_4\}$ ; 3; $A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{19}$ ; TP;
$\{R_2\}, \{R_3, R_4\}$ ; 3; $A_{13}, A_{10}, A_{19}$ ; TP;
$V$ ; $MA$ ; $C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3, R_4\}$ ; 3; $A_{13}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{19}$ ; TP;
$\{R_2\}, \{R_3, R_4\}$ ; 3; $A_{13}, A_{10}, A_{19}$ ; TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$S$ ; $ZA$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$Y$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$T$ ; $RA$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$W$ ; $XR$ ; $C_{2z}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 112

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$U$ ; $ZR$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3, R_4\}$ ; 3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ; TP;
$\{R_2\}, \{R_3, R_4\}$ ; 3; $A_{13}, A_{10}, A_{19}$ ; TP;
$V$ ; $MA$ ; $C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3, R_4\}$ ; 3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ; TP;
$\{R_2\}, \{R_3, R_4\}$ ; 3; $A_{13}, A_{10}, A_{19}$ ; TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$Y$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$T$ ; $RA$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$W$ ; $XR$ ; $C_{2z}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1

SG 113

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ZR$ ; $C_{2y}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{19}$ ;	TP;
	$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$V$ ; $MA$ ; $C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T}$ ;	$\{R_1, R_2\}, \{R_3, R_3\}$ ;	4; $\Gamma_{3,0}, \Gamma_{18}, \Gamma_{19}$ ;	DP; 0
	$\{R_1, R_2\}, \{R_4, R_4\}$ ;	4; $\Gamma_{3,0}, \Gamma_{20}, \Gamma_{19}$ ;	DP; 0
	$\{R_3, R_3\}, \{R_4, R_4\}$ ;	4; $-\Gamma_{0,0}, -\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	QDP; 0
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$S$ ; $ZA$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;

SG 114

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ZR$ ; $C_{2y}, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{19}$ ;	TP;
	$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$V$ ; $MA$ ; $C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T}$ ;	$\{R_1, R_2\}, \{R_3, R_3\}$ ;	4; $\Gamma_{3,0}, \Gamma_{18}, \Gamma_{19}$ ;	DP; 0
	$\{R_1, R_2\}, \{R_4, R_4\}$ ;	4; $\Gamma_{3,0}, \Gamma_{20}, \Gamma_{19}$ ;	DP; 0
	$\{R_3, R_3\}, \{R_4, R_4\}$ ;	4; $-\Gamma_{0,0}, -\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	QDP; 0
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;

## SG 115

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}\sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; $ZR$ ; $\sigma_x, \mathcal{T}\sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ;	TP;
	$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$V$ ; $MA$ ; $C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ;	TP;
	$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b} \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S$ ; $ZA$ ; $C_{2a}, C_{2b} \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Y$ ; $XM$ ; $\sigma_y, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$T$ ; $RA$ ; $\sigma_y, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$W$ ; $XR$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;

## SG 116

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}\sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ;	TP;
	$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$V$ ; $MA$ ; $C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ;	TP;
	$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b} \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S$ ; $ZA$ ; $C_{2a}, C_{2b} \mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Y$ ; $XM$ ; $\sigma_y, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$W$ ; $XR$ ; $C_{2z}, \sigma_y$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;

## SG 117

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}\sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$U$ ; $ZR$ ; $\sigma_x, \mathcal{T}\sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3, R_4\}$ ; 3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ; TP;
$\{R_2\}, \{R_3, R_4\}$ ; 3; $A_{13}, A_{10}, A_{19}$ ; TP;
$V$ ; $MA$ ; $\sigma_x, C_{2z}, S_{4z}^+ \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0$ ; P-WNLs;
$\{R_2\}, \{R_6, R_8\}$ ; 3; $-\frac{1}{3}i(A_0 + 2\sqrt{3}A_8), A_{13}, A_{19}$ ; TP;
$\{R_4\}, \{R_6, R_8\}$ ; 3; $-iA_{10}, A_{13}, A_{19}$ ; TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$S$ ; $ZA$ ; $C_{2a}, C_{2b} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 118

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}\sigma_y$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3, R_4\}$ ; 3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ; TP;
$\{R_2\}, \{R_3, R_4\}$ ; 3; $A_{13}, A_{10}, A_{19}$ ; TP;
$V$ ; $MA$ ; $\sigma_x, C_{2z}, S_{4z}^+ \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0$ ; P-WNLs;
$\{R_2\}, \{R_6, R_8\}$ ; 3; $-\frac{1}{3}i(A_0 + 2\sqrt{3}A_8), A_{13}, A_{19}$ ; TP;
$\{R_4\}, \{R_6, R_8\}$ ; 3; $-iA_{10}, A_{13}, A_{19}$ ; TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$S$ ; $ZA$ ; $C_{2a}, C_{2b} \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$T$ ; $RA$ ; $\sigma_y, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $-i\sigma_3, \sigma_0$ ; P-WNL;

## SG 119

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3, R_4\}$ ; 3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ; TP;
$\{R_2\}, \{R_3, R_4\}$ ; 3; $A_{13}, A_{10}, A_{19}$ ; TP;
$V$ ; $ZV$ ; $C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3, R_4\}$ ; 3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ; TP;
$\{R_2\}, \{R_3, R_4\}$ ; 3; $A_{13}, A_{10}, A_{19}$ ; TP;
$W$ ; $XP$ ; $C_{2z}, C_{2b} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ; $\sigma_y, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$F$ ; $ZF$ ; $\sigma_y, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Delta$ ; $\Gamma X$ ; $C_{2a}, C_{2b} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$U$ ; $ZU$ ; $C_{2a}, C_{2b} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$Y$ ; $XZ/XY$ ; $C_{2b}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ;	TP;
		$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$V$ ; $ZV$ ;	$C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ;	TP;
		$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$W$ ; $XP$ ;	$C_{2z}, C_{2b} \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma Z/\Gamma \Sigma$ ;	$\sigma_y, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $ZF$ ;	$\sigma_y, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $-\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma X$ ;	$C_{2a}, C_{2b} \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ZU$ ;	$C_{2a}, C_{2b} \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $-\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Y$ ; $XZ/XY$ ;	$C_{2b}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

## SG 121

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{19}$ ;	TP;
		$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$V$ ; $ZV$ ;	$C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{19}$ ;	TP;
		$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$W$ ; $XP$ ;	$C_{2z}, \sigma_{db}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$\Sigma$ ; $\Gamma Z/\Gamma \Sigma$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$F$ ; $ZF$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Q$ ; $NP$ ;	$C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3$ ;	C-1 WP; 1
$\Delta$ ; $\Gamma X$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; $ZU$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$Y$ ; $XZ/XY$ ;	$\sigma_{da}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;

## SG 122

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{19}$ ;	TP;
		$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$V$ ; $ZV$ ;	$\sigma_{da}, C_{2z}, S_{4z}^+ \mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $-i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
		$\{R_2\}, \{R_6, R_8\}$ ;	3; $-\frac{1}{3}i(A_0 + 2\sqrt{3}A_8), A_{13}, A_{19}$ ;	TP;
		$\{R_4\}, \{R_6, R_8\}$ ;	3; $-iA_{10}, A_{13}, A_{19}$ ;	TP;
$\Sigma$ ; $\Gamma Z/\Gamma \Sigma$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$F$ ; $ZF$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Q$ ; $NP$ ;	$C_{2y}$ ;	$\{R_4\}, \{R_8\}$ ;	2; $\sigma_3$ ;	C-1 WP; 1
$\Delta$ ; $\Gamma X$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;

$\Delta$ ; $\Gamma X$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $ZR$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $ZA$ ; $C_{2a, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

$Y$ ; XM;  $C_{2x,\sigma_z,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $T$ ; RA;  $C_{2x,\sigma_z,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $W$ ; XR;  $C_{2z,\sigma_y,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;



$\Delta$ ; $\Gamma X$ ; $C_{2y,\sigma_x,IT}$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13};$	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}, A_{13};$	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13};$	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}, A_{13};$	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13};$	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}, A_{13};$	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13};$	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}, A_{13};$	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a,\sigma_z,IT}$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
$Y$ ; $XM$ ; $C_{2x,\sigma_z,IT}$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
$W$ ; $XR$ ; $C_{2z,\sigma_y,IT}$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $ZR$ ; $C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, C_{2z}, \sigma_{da}, IT$ ;	$\{R_5\}, \{R_6\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_8\}$ ; 2; $-i\sigma_0, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_9\}$ ; 3; $-A_{30}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{32}$ ;	TP;
	$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_0, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}$ ; 3; $-A_{31}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{32}$ ;	TP;
	$\{R_7\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}$ ; 3; $-A_{31}, A_{13}, A_{10}, A_{32}$ ;	TP;
	$\{R_8\}, \{R_9\}$ ; 3; $-A_{30}, A_{13}, A_{10}, A_{32}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $ZA$ ; $C_{2a}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ;	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, C_{2z}, \sigma_{da}, IT$ ;	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
	$\{R_5\}, \{R_6\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_8\}$ ; 2; $-i\sigma_0, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_9\}$ ; 3; $-A_{30}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{32}$ ;	TP;
	$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_0, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}$ ; 3; $-A_{31}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{32}$ ;	TP;
	$\{R_7\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}$ ; 3; $-A_{31}, A_{13}, A_{10}, A_{32}$ ;	TP;
	$\{R_8\}, \{R_9\}$ ; 3; $-A_{30}, A_{13}, A_{10}, A_{32}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$T$ ; $RA$ ; $\sigma_y, C_{2x}, IT$ ;	$\{R_2\}, \{R_4\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_6\}$ ; 2; $-i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_6\}$ ; 2; $i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_8\}$ ; 2; $i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $ZR$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ;	3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ;	3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ;	3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ;	3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $\sigma_x, C_{2z}, \sigma_{da}, I\mathcal{T}$ ;	$\{R_5, R_6\}, \{R_{10}\}$ ;	4; $\Gamma_{21}, \Gamma_{3,0}, \Gamma_{22}, \Gamma_{23}$ ;	DP; 0
	$\{R_5, R_6\}, \{R_7, R_8\}$ ;	4; $-i\Gamma_{3,3}, \Gamma_{0,0}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	QDP; 0
	$\{R_7, R_8\}, \{R_{10}\}$ ;	4; $\Gamma_{24}, \Gamma_{3,0}, \Gamma_{25}, \Gamma_{23}$	DP; 0
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $ZA$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$Y$ ; $XM$ ; $\sigma_y, \sigma_z, I\mathcal{T}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$T$ ; $RA$ ; $\sigma_y, \sigma_z, I\mathcal{T}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ;	3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ;	3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ;	3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ;	3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $\sigma_x, C_{2z}, \sigma_{da}, I\mathcal{T}$ ;	$\{R_5, R_6\}, \{R_{10}\}$ ;	4; $\Gamma_{21}, \Gamma_{3,0}, \Gamma_{22}, \Gamma_{23}$ ;	DP; 0
	$\{R_5, R_6\}, \{R_7, R_8\}$ ;	4; $-i\Gamma_{3,3}, \Gamma_{0,0}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	QDP; 0
	$\{R_7, R_8\}, \{R_{10}\}$ ;	4; $\Gamma_{24}, \Gamma_{3,0}, \Gamma_{25}, \Gamma_{23}$	DP; 0
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$Y$ ; $XM$ ; $\sigma_y, \sigma_z, I\mathcal{T}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0

$\Delta$ ; $\Gamma X$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	$2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	$2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	$2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	$2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $ZR$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	$2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	$2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	$2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	$2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	$2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	$2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_4\}$ ;	$2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_5\}$ ;	$3; A_{29}, \frac{1}{3} (A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
$\{R_2\}, \{R_3\}$ ;	$2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_5\}$ ;	$3; A_{29}, A_{10}, A_{13}$ ;	TP;
$\{R_3\}, \{R_4\}$ ;	$2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_3\}, \{R_5\}$ ;	$3; -A_{19}, \frac{1}{3} (A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
$\{R_4\}, \{R_5\}$ ;	$3; -A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1, R_4\}, \{R_5\}$ ;	$4; \Gamma_{26}, \Gamma_{0,3}, (\frac{1}{2} - \frac{i}{2}) (\Gamma_{0,1} + i\Gamma_{3,1})$ ;	DP; 0
$\{R_1, R_4\}, \{R_2, R_3\}$ ;	$4; \Gamma_{0,3}, \Gamma_{3,3}, \Gamma_{0,1}$ ;	QDP; 0
$\{R_2, R_3\}, \{R_5\}$ ;	$4; \Gamma_{26}, -\Gamma_{3,3}, (\frac{1}{2} - \frac{i}{2}) (\Gamma_{0,1} + i\Gamma_{3,1})$ ;	DP; 0
$\Sigma$ ; $\Gamma M$ ; $C_{2a, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	$2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	$2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	$2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	$2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $ZA$ ; $C_{2a, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	$2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	$2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	$2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	$2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$W$ ; $XR$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1, R_4\}, \{R_2, R_3\}$ ;	$4; \Gamma_{0,3}, \Gamma_{3,3}, \Gamma_{0,1}$ ;	DP; 0

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y,\sigma_x,IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ;	3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ;	3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ;	3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ;	3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1, R_4\}, \{R_5\}$ ;	$\{R_1, R_4\}, \{R_5\}$ ;	4; $\Gamma_{26}, \Gamma_{0,3}, (\frac{1}{2} - \frac{i}{2})(\Gamma_{0,1} + i\Gamma_{3,1})$ ;	DP; 0
	$\{R_1, R_4\}, \{R_2, R_3\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,3}, \Gamma_{0,1}$ ;	QDP; 0
	$\{R_2, R_3\}, \{R_5\}$ ;	4; $\Gamma_{26}, -\Gamma_{3,3}, (\frac{1}{2} - \frac{i}{2})(\Gamma_{0,1} + i\Gamma_{3,1})$ ;	DP; 0
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$T$ ; $RA$ ; $C_{2x}, \sigma_y, IT$ ; $\{R_2, R_8\}, \{R_4, R_6\}$ ;	$\{R_2, R_8\}, \{R_4, R_6\}$ ;	4; $\Gamma_{3,3}, -i\Gamma_{0,3}, \Gamma_{0,1}$ ;	DP; 0
$W$ ; $XR$ ; $C_{2z}, \sigma_y, IT$ ; $\{R_1, R_4\}, \{R_2, R_3\}$ ;	$\{R_1, R_4\}, \{R_2, R_3\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,3}, \Gamma_{0,1}$ ;	DP; 0

## SG 131

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $ZR$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;



$Y$ ; XM;  $C_{2x,\sigma_z,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $T$ ; RA;  $C_{2x,\sigma_z,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $W$ ; XR;  $C_{2z,\sigma_y,IT}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;  
 $\{R_1\}, \{R_3\}$ ; 2;  $\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_1\}, \{R_4\}$ ; 2;  $\sigma_3, \sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_3\}$ ; 2;  $\sigma_3, -\sigma_3, \sigma_0$ ; P-WNL;  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_3, -\sigma_0, \sigma_0$ ; P-WNL;  
 $\{R_3\}, \{R_4\}$ ; 2;  $-\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;

$\Delta$ ; $\Gamma X$ ; $C_{2y, \sigma_x, IT}$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}, A_{13}$	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}, A_{13}$	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}, A_{13}$	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}, A_{13}$	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a, \sigma_z, IT}$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
$S$ ; $ZA$ ; $C_{2a, \sigma_{db}, IT}$	$\{R_2\}, \{R_4\}; 2; \sigma_3, \sigma_0, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_6\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_2\}, \{R_8\}; 2; \sigma_3, \sigma_3, \sigma_0$	P-WNL;
	$\{R_4\}, \{R_6\}; 2; -\sigma_3, \sigma_3, \sigma_0$	P-WNL;
	$\{R_4\}, \{R_8\}; 2; -\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_6\}, \{R_8\}; 2; \sigma_3, -\sigma_0, \sigma_0$	P-WNL;
$Y$ ; $XM$ ; $C_{2x, \sigma_z, IT}$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$	P-WNLs;

$W; \text{XR}; C_{2z, \sigma_y, I\mathcal{T}}; \{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0; \text{P-WNLs};$   
 $\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0; \text{P-WNL};$   
 $\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0; \text{P-WNL};$   
 $\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0; \text{P-WNL};$   
 $\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0; \text{P-WNL};$   
 $\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0; \text{P-WNLs};$

$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
$U; ZR; C_{2y}, \sigma_x, I\mathcal{T};$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13};$	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}, A_{13};$	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13};$	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}, A_{13};$	TP;
$V; MA; C_{4z}^+, C_{2z}, \sigma_{da}, I\mathcal{T};$	$\{R_5\}, \{R_6\}; 2; -i\sigma_3, \sigma_0, \sigma_0, \sigma_0;$	P-WNLs;
	$\{R_5\}, \{R_7\}; 2; -i\sigma_3, \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_5\}, \{R_8\}; 2; -i\sigma_0, \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_5\}, \{R_9\}; 3; -A_{30}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{32};$	TP;
	$\{R_6\}, \{R_7\}; 2; i\sigma_0, \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_6\}, \{R_8\}; 2; i\sigma_3, \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_6\}, \{R_9\}; 3; -A_{31}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{32};$	TP;
	$\{R_7\}, \{R_8\}; 2; i\sigma_3, \sigma_0, -\sigma_0, \sigma_0;$	P-WNLs;
	$\{R_7\}, \{R_9\}; 3; -A_{31}, A_{13}, A_{10}, A_{32};$	TP;
	$\{R_8\}, \{R_9\}; 3; -A_{30}, A_{13}, A_{10}, A_{32};$	TP;
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, C_{2z}, \sigma_{da}, IT$ ;	$\{R_5\}, \{R_6\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_8\}$ ; 2; $-i\sigma_0, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_9\}$ ; 3; $-A_{30}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{32}$ ;	TP;
	$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_0, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}$ ; 3; $-A_{31}, A_{13}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{32}$ ;	TP;
	$\{R_7\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}$ ; 3; $-A_{31}, A_{13}, A_{10}, A_{32}$ ;	TP;
	$\{R_8\}, \{R_9\}$ ; 3; $-A_{30}, A_{13}, A_{10}, A_{32}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $ZA$ ; $C_{2a}, \sigma_{db}, IT$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_6\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_8\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_6\}$ ; 2; $-\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_8\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$T$ ; $RA$ ; $\sigma_y, C_{2x}, IT$ ;	$\{R_2\}, \{R_4\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_6\}$ ; 2; $-i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_6\}$ ; 2; $i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_8\}$ ; 2; $i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $ZR$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ;	3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ;	3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ;	3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ;	3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $\sigma_x, C_{2z}, \sigma_{da}, I\mathcal{T}$ ;	$\{R_5, R_6\}, \{R_{10}\}$ ;	4; $\Gamma_{21}, \Gamma_{3,0}, \Gamma_{22}, \Gamma_{23}$ ;	DP; 0
	$\{R_5, R_6\}, \{R_7, R_8\}$ ;	4; $-i\Gamma_{3,3}, \Gamma_{0,0}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	QDP; 0
	$\{R_7, R_8\}, \{R_{10}\}$ ;	4; $\Gamma_{24}, \Gamma_{3,0}, \Gamma_{25}, \Gamma_{23}$ ;	DP; 0
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$Y$ ; $XM$ ; $C_{2x}, \sigma_z, I\mathcal{T}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0
$T$ ; $RA$ ; $C_{2x}, \sigma_z, I\mathcal{T}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ;	3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ;	3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ;	3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ;	3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $\sigma_x, C_{2z}, \sigma_{da}, I\mathcal{T}$ ;	$\{R_5, R_6\}, \{R_{10}\}$ ;	4; $\Gamma_{21}, \Gamma_{3,0}, \Gamma_{22}, \Gamma_{23}$ ;	DP; 0
	$\{R_5, R_6\}, \{R_7, R_8\}$ ;	4; $-i\Gamma_{3,3}, \Gamma_{0,0}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	QDP; 0
	$\{R_7, R_8\}, \{R_{10}\}$ ;	4; $\Gamma_{24}, \Gamma_{3,0}, \Gamma_{25}, \Gamma_{23}$ ;	DP; 0
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $ZA$ ; $C_{2a}, \sigma_{db}, I\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_6\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_8\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_6\}$ ;	2; $-\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_8\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$Y$ ; $XM$ ; $C_{2x}, \sigma_z, I\mathcal{T}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y,\sigma_x,IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_3\}$ ;	$2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	$2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	$2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	$2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $ZR$ ; $C_{2y,\sigma_x,IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_3\}$ ;	$2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	$2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	$2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	$2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_3\}$ ;	$2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	$2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ;	$2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_3\}$ ;	$3; A_{29}, \frac{1}{3} (A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ;	$2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_4\}$ ;	$3; A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_5\}$ ;	$2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_4\}, \{R_5\}$ ;	$3; -A_{19}, \frac{1}{3} (A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ;	$3; -A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1, R_4\}, \{R_5\}$ ;	$\{R_1, R_4\}, \{R_2, R_3\}$ ;	$4; \Gamma_{26}, \Gamma_{0,3}, \left(\frac{1}{2} - \frac{i}{2}\right) (\Gamma_{0,1} + i\Gamma_{3,1})$ ;	DP; 0
	$\{R_2, R_3\}, \{R_5\}$ ;	$4; \Gamma_{0,3}, \Gamma_{3,3}, \Gamma_{0,1}$ ;	QDP; 0
		$4; \Gamma_{26}, -\Gamma_{3,3}, \left(\frac{1}{2} - \frac{i}{2}\right) (\Gamma_{0,1} + i\Gamma_{3,1})$ ;	DP; 0
$\Sigma$ ; $\Gamma M$ ; $C_{2a,\sigma_z,IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_3\}$ ;	$2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	$2; \sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	$2; \sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	$2; \sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	$2; -\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$W$ ; $XR$ ; $C_{2z,\sigma_y,IT}$ ; $\{R_1, R_4\}, \{R_2, R_3\}$ ;	$4; \Gamma_{0,3}, \Gamma_{3,3}, \Gamma_{0,1}$ ;	DP;	0



## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y, \sigma_x, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ;	3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ;	3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ;	3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ;	3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_1, R_4\}, \{R_5\}$ ;	$\{R_1, R_4\}, \{R_5\}$ ;	4; $\Gamma_{26}, \Gamma_{0,3}, (\frac{1}{2} - \frac{i}{2})(\Gamma_{0,1} + i\Gamma_{3,1})$ ;	DP; 0
	$\{R_1, R_4\}, \{R_2, R_3\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,3}, \Gamma_{0,1}$ ;	QDP; 0
	$\{R_2, R_3\}, \{R_5\}$ ;	4; $\Gamma_{26}, -\Gamma_{3,3}, (\frac{1}{2} - \frac{i}{2})(\Gamma_{0,1} + i\Gamma_{3,1})$ ;	DP; 0
$\Sigma$ ; $\Gamma M$ ; $C_{2a, \sigma_z, IT}$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $ZA$ ; $C_{2a, \sigma_{db}, IT}$ ; $\{R_2\}, \{R_4\}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_6\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_8\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_6\}$ ;	2; $-\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_8\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$T$ ; $RA$ ; $C_{2x, \sigma_y, IT}$ ; $\{R_2, R_8\}, \{R_4, R_6\}$ ;	$\{R_2, R_8\}, \{R_4, R_6\}$ ;	4; $\Gamma_{3,3}, -i\Gamma_{0,3}, \Gamma_{0,1}$ ;	DP; 0
$W$ ; $XR$ ; $C_{2z, \sigma_y, IT}$ ; $\{R_1, R_4\}, \{R_2, R_3\}$ ;	$\{R_1, R_4\}, \{R_2, R_3\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,3}, \Gamma_{0,1}$ ;	DP; 0

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $ZV$ ; $C_{4z}^+, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$W$ ; $XP$ ; $C_{2z}, \sigma_{db}, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$F$ ; $ZF$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$Q$ ; $NP$ ; $C_{2y}, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

$\Delta$ ; $\Gamma X$ ;	$C_{2a,\sigma_z,IT}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2;	$\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2;	$\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2;	$\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2;	$\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2;	$-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$U$ ; $ZU$ ;	$C_{2a,\sigma_z,IT}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2;	$\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2;	$\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2;	$\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2;	$\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2;	$-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$Y$ ; $XZ/XY$ ;	$C_{2b,\sigma_{da},IT}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2;	$\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2;	$\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2;	$\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2;	$\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2;	$-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $ZV$ ; $C_{4z}^+, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$W$ ; $XP$ ; $C_{2z}, \sigma_{db}, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma Z/\Gamma \Sigma$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$F$ ; $ZF$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
$\Delta$ ; $\Gamma X$ ; $C_{2a}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

$U; \text{ZU}; \quad C_{2a, \sigma_z, IT}; \quad \{R_1\}, \{R_2\}; 2; -\sigma_0, -\sigma_3, \sigma_0; \text{P-WNLs};$   
 $\{R_1\}, \{R_3\}; 2; -\sigma_3, -\sigma_0, \sigma_0; \text{P-WNL};$   
 $\{R_1\}, \{R_4\}; 2; -\sigma_3, -\sigma_3, \sigma_0; \text{P-WNL};$   
 $\{R_2\}, \{R_3\}; 2; -\sigma_3, \sigma_3, \sigma_0; \text{P-WNL};$   
 $\{R_2\}, \{R_4\}; 2; -\sigma_3, \sigma_0, \sigma_0; \text{P-WNL};$   
 $\{R_3\}, \{R_4\}; 2; \sigma_0, -\sigma_3, \sigma_0; \text{P-WNLs};$   
 $Y; \text{XZ/XY}; \quad C_{2b, \sigma_{da}, IT}; \quad \{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0; \quad \text{P-WNLs};$   
 $\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0; \quad \text{P-WNL};$   
 $\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0; \quad \text{P-WNL};$   
 $\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0; \quad \text{P-WNL};$   
 $\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0; \quad \text{P-WNL};$   
 $\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0; \quad \text{P-WNLs};$

SG 141

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $ZV$ ; $C_{4z}^+, \sigma_x, E, IT$ ;	$\{R_6\}, \{R_{10}\}$ ; 3; $-iA_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_0, A_{13}$ ;	TP;
	$\{R_6\}, \{R_7\}$ ; 2; $-i\sigma_0, \sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}$ ; 2; $-i\sigma_3, \sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_{10}\}$ ; 3; $-iA_{29}, A_{10}, A_0, A_{13}$ ;	TP;
	$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_3, -\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}$ ; 2; $-i\sigma_3, -\sigma_0, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_8\}, \{R_{10}\}$ ; 3; $iA_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_0, A_{13}$ ;	TP;
	$\{R_8\}, \{R_9\}$ ; 2; $i\sigma_0, \sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_9\}, \{R_{10}\}$ ; 3; $iA_{19}, A_{10}, A_0, A_{13}$ ;	TP;
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $-\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $-\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $ZF$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_2\}, \{R_3\}$ ; 2; $-\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $-\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Q$ ; $NP$ ; $C_{2y}, IT$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$V$ ; $ZV$ ; $C_{4z}^+, \sigma_x, E, IT$ ;	$\{R_6\}, \{R_{10}\}$ ; 3; $iA_{29}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_0, A_{13}$ ;	TP;
	$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_0, \sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}$ ; 2; $i\sigma_3, \sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_{10}\}$ ; 3; $iA_{29}, A_{10}, A_0, A_{13}$ ;	TP;
	$\{R_7\}, \{R_8\}$ ; 2; $i\sigma_3, -\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}$ ; 2; $i\sigma_3, -\sigma_0, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_8\}, \{R_{10}\}$ ; 3; $-iA_{19}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_0, A_{13}$ ;	TP;
	$\{R_8\}, \{R_9\}$ ; 2; $-i\sigma_0, \sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_9\}, \{R_{10}\}$ ; 3; $-iA_{19}, A_{10}, A_0, A_{13}$ ;	TP;
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$F$ ; $ZF$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $-\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $-\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $-\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $-\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Delta$ ; $\Gamma X$ ; $C_{2a}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

## SG 143

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1

## SG 144

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1

## SG 145

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1

## SG 146

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma A/\Gamma Z$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$P$ ; $ZP$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1



## SG 147

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma A$ ;  $C_3^+, IT$ ;  $\{R_1\}, \{R_2, R_3\}$ ; 3;  $A_{33}, A_{17}$ ; TP;  
 $P$ ; KH;  $C_3^+, IT$ ;  $\{R_1\}, \{R_2, R_3\}$ ; 3;  $A_{33}, A_{17}$ ; TP;

## SG 148

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma\Lambda/\Gamma Z$ ;  $C_3^+, IT$ ;  $\{R_1\}, \{R_2, R_3\}$ ; 3;  $A_{33}, A_{17}$ ; TP;  
 $P$ ; ZP;  $C_3^+, IT$ ;  $\{R_1\}, \{R_2, R_3\}$ ; 3;  $A_{33}, A_{17}$ ; TP;

## SG 149

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma A$ ;  $C_3^+, C'_{22}\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $-\sigma_{10}, \sigma_0$ ; C-1 WP; 1  
 $\{R_1\}, \{R_3\}$ ; 2;  $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ; C-1 WP; 1  
 $\{R_2\}, \{R_3\}$ ; 2;  $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ; C-1 WP; 1  
 $P$ ; KH;  $C_3^+, C'_{22}\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $-\sigma_{10}, \sigma_0$ ; C-1 WP; 1  
 $\{R_1\}, \{R_3\}$ ; 2;  $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ; C-1 WP; 1  
 $\{R_2\}, \{R_3\}$ ; 2;  $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma M$ ;  $C'_{21}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $R$ ; AL;  $C'_{21}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1

## SG 150

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma A$ ;  $C_3^+, C''_{22}\mathcal{T}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $-\sigma_{10}, \sigma_0$ ; C-1 WP; 1  
 $\{R_1\}, \{R_3\}$ ; 2;  $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ; C-1 WP; 1  
 $\{R_2\}, \{R_3\}$ ; 2;  $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ; C-1 WP; 1  
 $P$ ; KH;  $C_3^+$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $-\sigma_{10}$ ; C-1 WP; 1  
 $\{R_1\}, \{R_3\}$ ; 2;  $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0)$ ; C-1 WP; 1  
 $\{R_2\}, \{R_3\}$ ; 2;  $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ; C-1 WP; 1  
 $T$ ;  $\Gamma K$ ;  $C''_{22}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $S$ ; AH;  $C''_{22}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $T'$ ; MK;  $C''_{21}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1  
 $S'$ ; LH;  $C''_{21}$ ;  $\{R_1\}, \{R_2\}$ ; 2;  $\sigma_3$ ; C-1 WP; 1

## SG 151

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, C'_{22}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+, C'_{22}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C'_{21}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1
$R$ ; $AL$ ; $C'_{21}$ ; $\{R_3\}, \{R_6\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1

## SG 152

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, C''_{22}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $C''_{22}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1
$S$ ; $AH$ ; $C''_{22}$ ; $\{R_2\}, \{R_5\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1
$T'$ ; $MK$ ; $C''_{21}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1
$S'$ ; $LH$ ; $C''_{21}$ ; $\{R_3\}, \{R_6\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1

## SG 153

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, C'_{22}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+, C'_{22}\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C'_{21}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1
$R$ ; $AL$ ; $C'_{21}$ ; $\{R_2\}, \{R_5\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1

## SG 154

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, C_{22}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+$ ;	$\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ; C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $C_{22}''$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; C-1 WP; 1
$S$ ; $AH$ ; $C_{22}''$ ;	$\{R_3\}, \{R_6\}$ ; 2; $\sigma_3$ ; C-1 WP; 1
$T'$ ; $MK$ ; $C_{21}''$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; C-1 WP; 1
$S'$ ; $LH$ ; $C_{21}''$ ;	$\{R_2\}, \{R_5\}$ ; 2; $\sigma_3$ ; C-1 WP; 1

## SG 155

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$P$ ; $ZP$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$B$ ; $ZB$ ; $C_{21}'$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; C-1 WP; 1
$\Sigma$ ; $\Gamma F/\Gamma \Sigma$ ; $C_{21}'$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; C-1 WP; 1
$Q$ ; $FQ$ ; $C_{23}'$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; C-1 WP; 1
$Y$ ; $LZ/LY$ ; $C_{22}'$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; C-1 WP; 1

## SG 156

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{1}{3} (A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}$ ;	TP;
$U$ ; $ML$ ; $\sigma_{v1}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; P-WNL;
$P$ ; $KH$ ; $C_3^+$ ;	$\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ; C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; P-WNL;
$R$ ; $AL$ ; $\sigma_{v1}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; P-WNL;

## SG 157

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}$ ;	TP;
$U$ ; ML; $\sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$P$ ; KH; $C_3^+, \sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}$ ;	TP;
$T$ ; $\Gamma K$ ; $\sigma_{d2}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$S$ ; AH; $\sigma_{d2}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$T'$ ; MK; $\sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$S'$ ; LH; $\sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;

## SG 158

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}$ ;	TP;
$U$ ; ML; $\sigma_{v1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$P$ ; KH; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$R$ ; AL; $\sigma_{v1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3$ ;	P-WNL;

## SG 159

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}$ ;	TP;
$U$ ; ML; $\sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$P$ ; KH; $C_3^+, \sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}$ ;	TP;
$T$ ; $\Gamma K$ ; $\sigma_{d2}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$S$ ; AH; $\sigma_{d2}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3$ ;	P-WNL;
$T'$ ; MK; $\sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$S'$ ; LH; $\sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3$ ;	P-WNL;

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_3^+, \sigma_{d1}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	3;	$A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
		$\{R_2\}, \{R_3\}$ ;	3;	$A_{36}, A_{10}$ ;	TP;
$P$ ; $ZP$ ;	$C_3^+, \sigma_{d1}$ ;	$\{R_1\}, \{R_2\}$ ;	2;	$\sigma_0, \sigma_3$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	3;	$A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
		$\{R_2\}, \{R_3\}$ ;	3;	$A_{36}, A_{10}$ ;	TP;

## SG 161

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_3^+, \sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}$ ;	TP;
$P$ ; $ZP$ ; $C_3^+, \sigma_{d1}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, -i\sigma_3$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, -i\frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, -iA_{10}$ ;	TP;

## SG 162

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$U$ ; $ML$ ; $\sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$T$ ; $\Gamma K$ ; $\sigma_{d2}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $AH$ ; $\sigma_{d2}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$T'$ ; $MK$ ; $\sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$S'$ ; $LH$ ; $\sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $C'_{21}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$R$ ; $AL$ ; $C'_{21}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;

## SG 163

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$U$ ; $ML$ ; $\sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$T$ ; $\Gamma K$ ; $\sigma_{d2}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $AH$ ; $\sigma_{d2}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3, \sigma_0$ ;	P-WNLs;
$T'$ ; $MK$ ; $\sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$S'$ ; $LH$ ; $\sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $C'_{21}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;

## SG 164

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ; TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ; TP;
$U$ ; ML; $\sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;
$P$ ; KH; $C_3^+, IT$ ; $\{R_1\}, \{R_2, R_3\}$ ; 3; $A_{33}, A_{17}$ ; TP;
$T$ ; $\Gamma K$ ; $C_{22}'', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$S$ ; AH; $C_{22}'', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$T'$ ; MK; $C_{21}'', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$S'$ ; LH; $C_{21}'', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;
$R$ ; AL; $\sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;

## SG 165

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ; TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ; TP;
$U$ ; ML; $\sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;
$P$ ; KH; $C_3^+, IT$ ; $\{R_1\}, \{R_2, R_3\}$ ; 3; $A_{33}, A_{17}$ ; TP;
$T$ ; $\Gamma K$ ; $C_{22}'', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$T'$ ; MK; $C_{21}'', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNLs;
$R$ ; AL; $\sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $-i\sigma_3, \sigma_0$ ; P-WNLs;

## SG 166

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma \Lambda / \Gamma Z$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ; TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ; TP;
$P$ ; ZP; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ; TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ; TP;
$B$ ; ZB; $C_{21}', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma F / \Gamma \Sigma$ ; $C_{21}', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$Q$ ; FQ; $C_{23}', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$Y$ ; LZ/LY; $C_{22}', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;

SG 167

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ; TP;	
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ; TP;	
$P$ ; $ZP$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;	
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ; TP;	
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ; TP;	
$\Sigma$ ; $\Gamma F/\Gamma\Sigma$ ; $C_{21}', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	
$Q$ ; $FQ$ ; $C_{23}', IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;	

SG 168

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_0 - (\sqrt[3]{-1} - 1)\sigma_3)$ ; C-1 WP; 1	
$\{R_1\}, \{R_3\}$ ; 2; $-\sigma_{10}$ ; C-2 WP; 2	
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3$ ; C-3 WP; 3	
$\{R_1\}, \{R_5\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0)$ ; C-2 WP; 2	
$\{R_1\}, \{R_6\}$ ; 2; $\frac{1}{2}((1 + (-1)^{2/3})\sigma_3 - ((-1)^{2/3} - 1)\sigma_0)$ ; C-1 WP; 1	
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(\sigma_3 + i\sqrt{3}\sigma_0)$ ; C-1 WP; 1	
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-2 WP; 2	
$\{R_2\}, \{R_5\}$ ; 2; $\sqrt[3]{-1}\sigma_3$ ; C-3 WP; 3	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3)$ ; C-2 WP; 2	
$\{R_3\}, \{R_4\}$ ; 2; $\frac{1}{2}(((1 + (-1)^{2/3})\sigma_0 + (1 + (-1)^{2/3})\sigma_3)$ ; C-1 WP; 1	
$\{R_3\}, \{R_5\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ; C-2 WP; 2	
$\{R_3\}, \{R_6\}$ ; 2; $(-1)^{2/3}\sigma_3$ ; C-3 WP; 3	
$\{R_4\}, \{R_5\}$ ; 2; $\frac{1}{2}((\sqrt[3]{-1} - 1)\sigma_3 - (1 + \sqrt[3]{-1})\sigma_0)$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-2 WP; 2	
$\{R_5\}, \{R_6\}$ ; 2; $-\frac{\sigma_3}{2} - \frac{1}{2}i\sqrt{3}\sigma_0$ ; C-1 WP; 1	
$U$ ; $ML$ ; $C_2$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ; C-1 WP; 1	
$P$ ; $KH$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ; C-1 WP; 1	
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0)$ ; C-1 WP; 1	
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ; C-1 WP; 1	



$\Delta; \Gamma A; C_6^+; \{R_1\}, \{R_2\}; 2; \frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_0 - (\sqrt[3]{-1} - 1) \sigma_3 \right);$	C-1 WP; 1
$\{R_1\}, \{R_3\}; 2; -\sigma_{10};$	C-2 WP; 2
$\{R_1\}, \{R_4\}; 2; \sigma_3;$	C-3 WP; 3
$\{R_1\}, \{R_5\}; 2; \frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right);$	C-2 WP; 2
$\{R_1\}, \{R_6\}; 2; \frac{1}{2} \left( \left( 1 + (-1)^{2/3} \right) \sigma_3 - \left( (-1)^{2/3} - 1 \right) \sigma_0 \right);$	C-1 WP; 1
$\{R_2\}, \{R_3\}; 2; \frac{1}{2} (\sigma_3 + i\sqrt{3}\sigma_0);$	C-1 WP; 1
$\{R_2\}, \{R_4\}; 2; \sigma_9;$	C-2 WP; 2
$\{R_2\}, \{R_5\}; 2; \sqrt[3]{-1}\sigma_3;$	C-3 WP; 3
$\{R_2\}, \{R_6\}; 2; \frac{1}{2} (\sigma_0 + i\sqrt{3}\sigma_3);$	C-2 WP; 2
$\{R_3\}, \{R_4\}; 2; \frac{1}{2} \left( \left( (-1)^{2/3} - 1 \right) \sigma_0 + \left( 1 + (-1)^{2/3} \right) \sigma_3 \right);$	C-1 WP; 1
$\{R_3\}, \{R_5\}; 2; \frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3);$	C-2 WP; 2
$\{R_3\}, \{R_6\}; 2; (-1)^{2/3}\sigma_3;$	C-3 WP; 3
$\{R_4\}, \{R_5\}; 2; \frac{1}{2} \left( (\sqrt[3]{-1} - 1) \sigma_3 - (1 + \sqrt[3]{-1}) \sigma_0 \right);$	C-1 WP; 1
$\{R_4\}, \{R_6\}; 2; \sigma_{10};$	C-2 WP; 2
$\{R_5\}, \{R_6\}; 2; -\frac{\sigma_3}{2} - \frac{1}{2} i\sqrt{3}\sigma_0;$	C-1 WP; 1
$U; ML; C_2; \{R_1\}, \{R_2\}; 2; \sigma_3;$	C-1 WP; 1
$P; KH; C_3^+; \{R_1\}, \{R_2\}; 2; -\sigma_{10};$	C-1 WP; 1
$\{R_1\}, \{R_3\}; 2; \frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right);$	C-1 WP; 1
$\{R_2\}, \{R_3\}; 2; \frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3);$	C-1 WP; 1

$\Delta; \Gamma A; C_6^+; \{R_1\}, \{R_2\}; 2; \frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_0 - (\sqrt[3]{-1} - 1) \sigma_3 \right);$	C-1 WP; 1
$\{R_1\}, \{R_3\}; 2; -\sigma_{10};$	C-2 WP; 2
$\{R_1\}, \{R_4\}; 2; \sigma_3;$	C-3 WP; 3
$\{R_1\}, \{R_5\}; 2; \frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right);$	C-2 WP; 2
$\{R_1\}, \{R_6\}; 2; \frac{1}{2} \left( \left( 1 + (-1)^{2/3} \right) \sigma_3 - \left( (-1)^{2/3} - 1 \right) \sigma_0 \right);$	C-1 WP; 1
$\{R_2\}, \{R_3\}; 2; \frac{1}{2} (\sigma_3 + i\sqrt{3}\sigma_0);$	C-1 WP; 1
$\{R_2\}, \{R_4\}; 2; \sigma_9;$	C-2 WP; 2
$\{R_2\}, \{R_5\}; 2; \sqrt[3]{-1}\sigma_3;$	C-3 WP; 3
$\{R_2\}, \{R_6\}; 2; \frac{1}{2} (\sigma_0 + i\sqrt{3}\sigma_3);$	C-2 WP; 2
$\{R_3\}, \{R_4\}; 2; \frac{1}{2} \left( \left( (-1)^{2/3} - 1 \right) \sigma_0 + \left( 1 + (-1)^{2/3} \right) \sigma_3 \right);$	C-1 WP; 1
$\{R_3\}, \{R_5\}; 2; \frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3);$	C-2 WP; 2
$\{R_3\}, \{R_6\}; 2; (-1)^{2/3}\sigma_3;$	C-3 WP; 3
$\{R_4\}, \{R_5\}; 2; \frac{1}{2} \left( (\sqrt[3]{-1} - 1) \sigma_3 - (1 + \sqrt[3]{-1}) \sigma_0 \right);$	C-1 WP; 1
$\{R_4\}, \{R_6\}; 2; \sigma_{10};$	C-2 WP; 2
$\{R_5\}, \{R_6\}; 2; -\frac{\sigma_3}{2} - \frac{1}{2} i\sqrt{3}\sigma_0;$	C-1 WP; 1
$U; ML; C_2; \{R_1\}, \{R_2\}; 2; \sigma_3;$	C-1 WP; 1
$P; KH; C_3^+; \{R_1\}, \{R_2\}; 2; -\sigma_{10};$	C-1 WP; 1
$\{R_1\}, \{R_3\}; 2; \frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right);$	C-1 WP; 1
$\{R_2\}, \{R_3\}; 2; \frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3);$	C-1 WP; 1

SG 171

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_0 - (\sqrt[3]{-1} - 1) \sigma_3 \right)$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $-\sigma_{10}$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3$ ;	C-3 WP; 3
$\{R_1\}, \{R_5\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-2 WP; 2
$\{R_1\}, \{R_6\}$ ; 2; $\frac{1}{2} \left( \left( 1 + (-1)^{2/3} \right) \sigma_3 - \left( (-1)^{2/3} - 1 \right) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (\sigma_3 + i\sqrt{3}\sigma_0)$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ;	C-2 WP; 2
$\{R_2\}, \{R_5\}$ ; 2; $\sqrt[3]{-1}\sigma_3$ ;	C-3 WP; 3
$\{R_2\}, \{R_6\}$ ; 2; $\frac{1}{2} (\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $\frac{1}{2} \left( \left( (-1)^{2/3} - 1 \right) \sigma_0 + \left( 1 + (-1)^{2/3} \right) \sigma_3 \right)$ ;	C-1 WP; 1
$\{R_3\}, \{R_5\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-2 WP; 2
$\{R_3\}, \{R_6\}$ ; 2; $(-1)^{2/3}\sigma_3$ ;	C-3 WP; 3
$\{R_4\}, \{R_5\}$ ; 2; $\frac{1}{2} \left( (\sqrt[3]{-1} - 1) \sigma_3 - (1 + \sqrt[3]{-1}) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ;	C-2 WP; 2
$\{R_5\}, \{R_6\}$ ; 2; $-\frac{\sigma_3}{2} - \frac{1}{2} i\sqrt{3}\sigma_0$ ;	C-1 WP; 1
$U$ ; ML; $C_2$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1
$P$ ; KH; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1

$\Delta; \Gamma A; C_6^+; \{R_1\}, \{R_2\}; 2; \frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_0 - (\sqrt[3]{-1} - 1) \sigma_3 \right);$	C-1 WP; 1
$\{R_1\}, \{R_3\}; 2; -\sigma_{10};$	C-2 WP; 2
$\{R_1\}, \{R_4\}; 2; \sigma_3;$	C-3 WP; 3
$\{R_1\}, \{R_5\}; 2; \frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right);$	C-2 WP; 2
$\{R_1\}, \{R_6\}; 2; \frac{1}{2} \left( \left( 1 + (-1)^{2/3} \right) \sigma_3 - \left( (-1)^{2/3} - 1 \right) \sigma_0 \right);$	C-1 WP; 1
$\{R_2\}, \{R_3\}; 2; \frac{1}{2} (\sigma_3 + i\sqrt{3}\sigma_0);$	C-1 WP; 1
$\{R_2\}, \{R_4\}; 2; \sigma_9;$	C-2 WP; 2
$\{R_2\}, \{R_5\}; 2; \sqrt[3]{-1}\sigma_3;$	C-3 WP; 3
$\{R_2\}, \{R_6\}; 2; \frac{1}{2} (\sigma_0 + i\sqrt{3}\sigma_3);$	C-2 WP; 2
$\{R_3\}, \{R_4\}; 2; \frac{1}{2} \left( \left( (-1)^{2/3} - 1 \right) \sigma_0 + \left( 1 + (-1)^{2/3} \right) \sigma_3 \right);$	C-1 WP; 1
$\{R_3\}, \{R_5\}; 2; \frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3);$	C-2 WP; 2
$\{R_3\}, \{R_6\}; 2; (-1)^{2/3}\sigma_3;$	C-3 WP; 3
$\{R_4\}, \{R_5\}; 2; \frac{1}{2} \left( (\sqrt[3]{-1} - 1) \sigma_3 - (1 + \sqrt[3]{-1}) \sigma_0 \right);$	C-1 WP; 1
$\{R_4\}, \{R_6\}; 2; \sigma_{10};$	C-2 WP; 2
$\{R_5\}, \{R_6\}; 2; -\frac{\sigma_3}{2} - \frac{1}{2} i\sqrt{3}\sigma_0;$	C-1 WP; 1
$U; ML; C_2; \{R_1\}, \{R_2\}; 2; \sigma_3;$	C-1 WP; 1
$P; KH; C_3^+; \{R_1\}, \{R_2\}; 2; -\sigma_{10};$	C-1 WP; 1
$\{R_1\}, \{R_3\}; 2; \frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right);$	C-1 WP; 1
$\{R_2\}, \{R_3\}; 2; \frac{1}{2} (-\sigma_0 + i\sqrt{3}\sigma_3);$	C-1 WP; 1

SG 173

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_0 - (\sqrt[3]{-1} - 1)\sigma_3)$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $-\sigma_{10}$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3$ ;	C-3 WP; 3
$\{R_1\}, \{R_5\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0)$ ;	C-2 WP; 2
$\{R_1\}, \{R_6\}$ ; 2; $\frac{1}{2}((1 + (-1)^{2/3})\sigma_3 - ((-1)^{2/3} - 1)\sigma_0)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(\sigma_3 + i\sqrt{3}\sigma_0)$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ;	C-2 WP; 2
$\{R_2\}, \{R_5\}$ ; 2; $\sqrt[3]{-1}\sigma_3$ ;	C-3 WP; 3
$\{R_2\}, \{R_6\}$ ; 2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $\frac{1}{2}(((1 + (-1)^{2/3})\sigma_0 + (1 + (-1)^{2/3})\sigma_3))$ ;	C-1 WP; 1
$\{R_3\}, \{R_5\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-2 WP; 2
$\{R_3\}, \{R_6\}$ ; 2; $(-1)^{2/3}\sigma_3$ ;	C-3 WP; 3
$\{R_4\}, \{R_5\}$ ; 2; $\frac{1}{2}((\sqrt[3]{-1} - 1)\sigma_3 - (1 + \sqrt[3]{-1})\sigma_0)$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ;	C-2 WP; 2
$\{R_5\}, \{R_6\}$ ; 2; $-\frac{\sigma_3}{2} - \frac{1}{2}i\sqrt{3}\sigma_0$ ;	C-1 WP; 1
$U$ ; $ML$ ; $C_2$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0)$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1

SG 174

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, S_3^+ \mathcal{T}$ ; $\{R_1\}, \{R_2, R_3\}$ ; 3; $A_{33}, A_{34}$ ;	TP;
$P$ ; $KH$ ; $C_3^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0}{2}$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $\sigma_h$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$S$ ; $AH$ ; $\sigma_h$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$T'$ ; $MK$ ; $\sigma_h$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$S'$ ; $LH$ ; $\sigma_h$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$\Sigma$ ; $\Gamma M$ ; $\sigma_h$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;
$R$ ; $AL$ ; $\sigma_h$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3$ ;	P-WNL;

SG 175

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, IT$ ; $\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_2, R_6\}$ ;	3; $A_{35}, A_{17}$ ;	TP;
$\{R_1\}, \{R_3, R_5\}$ ;	3; $A_{33}, A_{17}$ ;	QTP;
$\{R_2, R_6\}, \{R_4\}$ ;	3; $\frac{\sqrt{3}(A_8+iA_5)}{2}, A_{20}$ ;	QTP;
$\{R_2, R_6\}, \{R_3, R_5\}$ ;	4; $\frac{\Gamma_{3,0}+i\sqrt{3}\Gamma_{0,3}}{2}, \Gamma_{0,1}$ ;	DP; 0
$\{R_3, R_5\}, \{R_4\}$ ;	3; $\frac{-4A_0+\sqrt{3}(A_8+3iA_5)}{6}, A_{20}$ ;	TP;
$U$ ; ML; $C_2, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$P$ ; KH; $C_3^+, IT$ ; $\{R_1\}, \{R_2, R_3\}$ ;	3; $A_{33}, A_{17}$ ;	TP;
$T$ ; $\Gamma K$ ; $\sigma_h, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; AH; $\sigma_h, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$T'$ ; MK; $\sigma_h, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$S'$ ; LH; $\sigma_h, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $\sigma_h, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$R$ ; AL; $\sigma_h, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;

SG 176

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, IT$ ; $\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_2, R_6\}$ ;	3; $A_{35}, A_{17}$ ;	TP;
$\{R_1\}, \{R_3, R_5\}$ ;	3; $A_{33}, A_{17}$ ;	QTP;
$\{R_2, R_6\}, \{R_4\}$ ;	3; $\frac{\sqrt{3}(A_8+iA_5)}{2}, A_{20}$ ;	QTP;
$\{R_2, R_6\}, \{R_3, R_5\}$ ;	4; $\frac{\Gamma_{3,0}+i\sqrt{3}\Gamma_{0,3}}{2}, \Gamma_{0,1}$ ;	DP; 0
$\{R_3, R_5\}, \{R_4\}$ ;	3; $\frac{-4A_0+\sqrt{3}(A_8+3iA_5)}{6}, A_{20}$ ;	TP;
$U$ ; ML; $C_2, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$P$ ; KH; $C_3^+, IT$ ; $\{R_1\}, \{R_2, R_3\}$ ;	3; $A_{33}, A_{17}$ ;	TP;
$T$ ; $\Gamma K$ ; $\sigma_h, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$T'$ ; MK; $\sigma_h, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $\sigma_h, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;

$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_0 - (\sqrt[3]{-1} - 1)\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_1\}, \{R_5\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_6\}$ ; 2; $\frac{1}{2}((1 + (-1)^{2/3})\sigma_3 - ((-1)^{2/3} - 1)\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(\sigma_3 + i\sqrt{3}\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ;	C-2 WP; 2
$\{R_2\}, \{R_5\}$ ; 2; $\sqrt[3]{-1}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_2\}, \{R_6\}$ ; 2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $\frac{1}{2}(((1 + (-1)^{2/3})\sigma_0 + (1 + (-1)^{2/3})\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_3\}, \{R_5\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_6\}$ ; 2; $(-1)^{2/3}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_4\}, \{R_5\}$ ; 2; $\frac{1}{2}((\sqrt[3]{-1} - 1)\sigma_3 - (1 + \sqrt[3]{-1})\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_5\}, \{R_6\}$ ; 2; $-\frac{\sigma_3}{2} - \frac{1}{2}i\sqrt{3}\sigma_0, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ML$ ; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S$ ; $AH$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T'$ ; $MK$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S'$ ; $LH$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$R$ ; $AL$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_0 - (\sqrt[3]{-1} - 1) \sigma_3 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_1\}, \{R_5\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right), \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_6\}$ ; 2; $\frac{1}{2} \left( \left( 1 + (-1)^{2/3} \right) \sigma_3 - \left( (-1)^{2/3} - 1 \right) \sigma_0 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( \sigma_3 + i\sqrt{3}\sigma_0 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ;	C-2 WP; 2
$\{R_2\}, \{R_5\}$ ; 2; $\sqrt[3]{-1}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_2\}, \{R_6\}$ ; 2; $\frac{1}{2} \left( \sigma_0 + i\sqrt{3}\sigma_3 \right), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $\frac{1}{2} \left( \left( (-1)^{2/3} - 1 \right) \sigma_0 + \left( 1 + (-1)^{2/3} \right) \sigma_3 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_3\}, \{R_5\}$ ; 2; $\frac{1}{2} \left( -\sigma_0 + i\sqrt{3}\sigma_3 \right), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_6\}$ ; 2; $(-1)^{2/3}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_4\}, \{R_5\}$ ; 2; $\frac{1}{2} \left( (\sqrt[3]{-1} - 1) \sigma_3 - (1 + \sqrt[3]{-1}) \sigma_0 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_5\}, \{R_6\}$ ; 2; $-\frac{\sigma_3}{2} - \frac{1}{2}i\sqrt{3}\sigma_0, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ML$ ; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( -\sigma_0 + i\sqrt{3}\sigma_3 \right), \sigma_0$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T'$ ; $MK$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1



$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_0 - (\sqrt[3]{-1} - 1) \sigma_3 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_1\}, \{R_5\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right), \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_6\}$ ; 2; $\frac{1}{2} \left( \left( 1 + (-1)^{2/3} \right) \sigma_3 - \left( (-1)^{2/3} - 1 \right) \sigma_0 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( \sigma_3 + i\sqrt{3}\sigma_0 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ;	C-2 WP; 2
$\{R_2\}, \{R_5\}$ ; 2; $\sqrt[3]{-1}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_2\}, \{R_6\}$ ; 2; $\frac{1}{2} \left( \sigma_0 + i\sqrt{3}\sigma_3 \right), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $\frac{1}{2} \left( \left( (-1)^{2/3} - 1 \right) \sigma_0 + \left( 1 + (-1)^{2/3} \right) \sigma_3 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_3\}, \{R_5\}$ ; 2; $\frac{1}{2} \left( -\sigma_0 + i\sqrt{3}\sigma_3 \right), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_6\}$ ; 2; $(-1)^{2/3}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_4\}, \{R_5\}$ ; 2; $\frac{1}{2} \left( (\sqrt[3]{-1} - 1) \sigma_3 - (1 + \sqrt[3]{-1}) \sigma_0 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_5\}, \{R_6\}$ ; 2; $-\frac{\sigma_3}{2} - \frac{1}{2}i\sqrt{3}\sigma_0, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ML$ ; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( (1 + \sqrt[3]{-1}) \sigma_3 - (\sqrt[3]{-1} - 1) \sigma_0 \right), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2} \left( -\sigma_0 + i\sqrt{3}\sigma_3 \right), \sigma_0$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T'$ ; $MK$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_0 - (\sqrt[3]{-1} - 1)\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_1\}, \{R_5\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_6\}$ ; 2; $\frac{1}{2}((1 + (-1)^{2/3})\sigma_3 - ((-1)^{2/3} - 1)\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(\sigma_3 + i\sqrt{3}\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ;	C-2 WP; 2
$\{R_2\}, \{R_5\}$ ; 2; $\sqrt[3]{-1}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_2\}, \{R_6\}$ ; 2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $\frac{1}{2}(((1 + (-1)^{2/3})\sigma_0 + (1 + (-1)^{2/3})\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_3\}, \{R_5\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_6\}$ ; 2; $(-1)^{2/3}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_4\}, \{R_5\}$ ; 2; $\frac{1}{2}((\sqrt[3]{-1} - 1)\sigma_3 - (1 + \sqrt[3]{-1})\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_5\}, \{R_6\}$ ; 2; $-\frac{\sigma_3}{2} - \frac{1}{2}i\sqrt{3}\sigma_0, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ML$ ; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{1}{2}((1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S$ ; $AH$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_5\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T'$ ; $MK$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S'$ ; $LH$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$R$ ; $AL$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

SG 181

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_0 - (\sqrt[3]{-1}-1)\sigma_3}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_1\}, \{R_5\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_6\}$ ; 2; $\frac{(1+(-1)^{2/3})\sigma_3 - ((-1)^{2/3}-1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(\sigma_3 + i\sqrt{3}\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ;	C-2 WP; 2
$\{R_2\}, \{R_5\}$ ; 2; $\sqrt[3]{-1}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_2\}, \{R_6\}$ ; 2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $\frac{((-1)^{2/3}-1)\sigma_0 + (1+(-1)^{2/3})\sigma_3}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_3\}, \{R_5\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_6\}$ ; 2; $(-1)^{2/3}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_4\}, \{R_5\}$ ; 2; $\frac{(\sqrt[3]{-1}-1)\sigma_3 - (1+\sqrt[3]{-1})\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_5\}, \{R_6\}$ ; 2; $-\frac{\sigma_3}{2} - \frac{1}{2}i\sqrt{3}\sigma_0, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ML$ ; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S$ ; $AH$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T'$ ; $MK$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S'$ ; $LH$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$R$ ; $AL$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_0 - (\sqrt[3]{-1}-1)\sigma_3}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_1\}, \{R_5\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_6\}$ ; 2; $\frac{(1+(-1)^{2/3})\sigma_3 - ((-1)^{2/3}-1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(\sigma_3 + i\sqrt{3}\sigma_0), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ;	C-2 WP; 2
$\{R_2\}, \{R_5\}$ ; 2; $\sqrt[3]{-1}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_2\}, \{R_6\}$ ; 2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $\frac{((-1)^{2/3}-1)\sigma_0 + (1+(-1)^{2/3})\sigma_3}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_3\}, \{R_5\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_6\}$ ; 2; $(-1)^{2/3}\sigma_3, \sigma_0$ ;	C-3 WP; 3
$\{R_4\}, \{R_5\}$ ; 2; $\frac{(\sqrt[3]{-1}-1)\sigma_3 - (1+\sqrt[3]{-1})\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ;	C-2 WP; 2
$\{R_5\}, \{R_6\}$ ; 2; $-\frac{\sigma_3}{2} - \frac{1}{2}i\sqrt{3}\sigma_0, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ML$ ; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T'$ ; $MK$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{v1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	QTP;
	$\{R_1\}, \{R_6\}; 3; A_{39}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{36}, A_{10}$ ;	QTP;
	$\{R_2\}, \{R_6\}; 3; A_{39}, A_{10}$ ;	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; A_{40}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_3\}, \{R_6\}; 3; A_{24}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	QTP;
	$\{R_4\}, \{R_5\}; 3; A_{40}, A_{10}$ ;	TP;
	$\{R_4\}, \{R_6\}; 3; A_{24}, A_{10}$ ;	QTP;
	$\{R_5\}, \{R_6\}; 4; -\frac{\Gamma_{3,0}}{2} - \frac{1}{2}i\sqrt{3}\Gamma_{0,2}, \Gamma_{0,3}$ ;	DP; 0
$U$ ; ML; $C_{2, \sigma_{v1}}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
$P$ ; KH; $C_3^+, \sigma_{d1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 3; A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_2\}, \{R_3\}; 3; A_{36}, A_{10}$ ;	TP;
$T$ ; $\Gamma K$ ; $\sigma_{d2}, \mathcal{T}\sigma_{v2}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$S$ ; AH; $\sigma_{d2}, \mathcal{T}\sigma_{v2}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$T'$ ; MK; $\sigma_{d1}, C_2\mathcal{T}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$S'$ ; LH; $\sigma_{d1}, C_2\mathcal{T}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}, \mathcal{T}\sigma_{d1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$R$ ; AL; $\sigma_{v1}, \mathcal{T}\sigma_{d1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{v1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	QTP;
	$\{R_1\}, \{R_6\}; 3; A_{39}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{36}, A_{10}$ ;	QTP;
	$\{R_2\}, \{R_6\}; 3; A_{39}, A_{10}$ ;	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; A_{40}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_3\}, \{R_6\}; 3; A_{24}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	QTP;
	$\{R_4\}, \{R_5\}; 3; A_{40}, A_{10}$ ;	TP;
	$\{R_4\}, \{R_6\}; 3; A_{24}, A_{10}$ ;	QTP;
	$\{R_5\}, \{R_6\}; 4; -\frac{\Gamma_{3,0}}{2} - \frac{1}{2}i\sqrt{3}\Gamma_{0,2}, \Gamma_{0,3}$ ;	DP; 0
$U$ ; ML; $C_{2,\sigma_{v1}}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
$P$ ; KH; $C_3^+, \sigma_{d1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 3; A_{36}, \frac{A_0 + 2\sqrt{3}A_8}{3}$ ;	TP;
	$\{R_2\}, \{R_3\}; 3; A_{36}, A_{10}$ ;	TP;
$T$ ; $\Gamma K$ ; $\sigma_{d2}, \mathcal{T}\sigma_{v2}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$T'$ ; MK; $\sigma_{d1}, C_2\mathcal{T}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}, \mathcal{T}\sigma_{d1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{v1}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNLs;	
	$\{R_1\}, \{R_5\}$ ;	3; $A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	QTP;	
	$\{R_1\}, \{R_6\}$ ;	3; $A_{39}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;	
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNLs;	
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNLs;	
	$\{R_2\}, \{R_5\}$ ;	3; $A_{36}, A_{10}$ ;	QTP;	
	$\{R_2\}, \{R_6\}$ ;	3; $A_{39}, A_{10}$ ;	TP;	
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;	
	$\{R_3\}, \{R_5\}$ ;	3; $A_{40}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;	
	$\{R_3\}, \{R_6\}$ ;	3; $A_{24}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	QTP;	
	$\{R_4\}, \{R_5\}$ ;	3; $A_{40}, A_{10}$ ;	TP;	
	$\{R_4\}, \{R_6\}$ ;	3; $A_{24}, A_{10}$ ;	QTP;	
	$\{R_5\}, \{R_6\}$ ;	4; $-\frac{\Gamma_{3,0}}{2} - \frac{1}{2}i\sqrt{3}\Gamma_{0,2}, \Gamma_{0,3}$ ;	DP;	0
$U$ ; $ML$ ; $C_2, \sigma_{v1}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;	
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;	
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;	
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;	
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0 + 2\sqrt{3}A_8}{3}$ ;	TP;	
	$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, A_{10}$ ;	TP;	
$T$ ; $\Gamma K$ ; $\sigma_{d2}, \mathcal{T}\sigma_{v2}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;	
$S$ ; $AH$ ; $\sigma_{d2}, \mathcal{T}\sigma_{v2}$ ;	$\{R_1, R_1\}, \{R_2, R_2\}$ ;	4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	DP;	0
$T'$ ; $MK$ ; $\sigma_{d1}, C_2\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;	
$S'$ ; $LH$ ; $\sigma_{d1}, C_2\mathcal{T}$ ;	$\{R_1, R_1\}, \{R_2, R_2\}$ ;	4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	DP;	0
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}, \mathcal{T}\sigma_{d1}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;	

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{v1}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ;	3; $A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	QTP;
	$\{R_1\}, \{R_6\}$ ;	3; $A_{39}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ;	3; $A_{36}, A_{10}$ ;	QTP;
	$\{R_2\}, \{R_6\}$ ;	3; $A_{39}, A_{10}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ;	3; $A_{40}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	TP;
	$\{R_3\}, \{R_6\}$ ;	3; $A_{24}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8)$ ;	QTP;
	$\{R_4\}, \{R_5\}$ ;	3; $A_{40}, A_{10}$ ;	TP;
	$\{R_4\}, \{R_6\}$ ;	3; $A_{24}, A_{10}$ ;	QTP;
	$\{R_5\}, \{R_6\}$ ;	4; $-\frac{\Gamma_{3,0}}{2} - \frac{1}{2}i\sqrt{3}\Gamma_{0,2}, \Gamma_{0,3}$ ;	DP; 0
$U$ ; ML; $C_2, \sigma_{v1}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$P$ ; KH; $C_3^+, \sigma_{d1}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0 + 2\sqrt{3}A_8}{3}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, A_{10}$ ;	TP;
$T$ ; $\Gamma K$ ; $\sigma_{d2}, \mathcal{T}\sigma_{v2}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$T'$ ; MK; $\sigma_{d1}, C_2\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}, \mathcal{T}\sigma_{d1}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$R$ ; AL; $\sigma_{v1}, \mathcal{T}\sigma_{d1}$ ;	$\{R_1, R_1\}, \{R_2, R_2\}$ ;	4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	DP; 0



SG 187

Accidental degeneracies on high symmetry line

	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
$\Delta; \Gamma A; C_3^+, \sigma_{v1}, S_3^+ \mathcal{T};$	$\{R_1\}, \{R_3\}; 3; A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{36};$	TP;
	$\{R_2\}, \{R_3\}; 3; A_{36}, A_{10}, A_{36};$	TP;
$U; ML; \sigma_{v1}, \mathcal{T}\sigma_h;$	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$P; KH; C_3^+, C'_{23} \mathcal{T};$	$\{R_1\}, \{R_2\}; 2; -\sigma_{10}, \sigma_0;$	C-1 WP; 1
	$\{R_1\}, \{R_3\}; 2; \frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0;$	C-1 WP; 1
	$\{R_2\}, \{R_3\}; 2; \frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0;$	C-1 WP; 1
$T; \Gamma K; \sigma_h, \mathcal{T}\sigma_{v2};$	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$S; AH; \sigma_h, \mathcal{T}\sigma_{v2};$	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$T'; MK; \sigma_h, \mathcal{T}\sigma_{v1};$	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$S'; LH; \sigma_h, \mathcal{T}\sigma_{v1};$	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$\Sigma; \Gamma M; C'_{21}, \sigma_{v1};$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3;$	P-WNLs;
$R; AL; C'_{21}, \sigma_{v1};$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3;$	P-WNLs;

SG 188

Accidental degeneracies on high symmetry line

$\Delta; \Gamma A; C_3^+, \sigma_{v1}, S_3^+ \mathcal{T};$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 3; A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{36};$	TP;
	$\{R_2\}, \{R_3\}; 3; A_{36}, A_{10}, A_{36};$	TP;
$U; ML; \sigma_{v1}, \mathcal{T}\sigma_h;$	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$P; KH; C_3^+, C'_{23} \mathcal{T};$	$\{R_1\}, \{R_2\}; 2; -\sigma_{10}, \sigma_0;$	C-1 WP; 1
	$\{R_1\}, \{R_3\}; 2; \frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0;$	C-1 WP; 1
	$\{R_2\}, \{R_3\}; 2; \frac{-\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0;$	C-1 WP; 1
$T; \Gamma K; \sigma_h, \mathcal{T}\sigma_{v2};$	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$T'; MK; \sigma_h, \mathcal{T}\sigma_{v1};$	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0;$	P-WNL;
$\Sigma; \Gamma M; C'_{21}, \sigma_{v1};$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3;$	P-WNLs;

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{d1}, S_3^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 3; A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{36}$ ;	TP;
	$\{R_2\}, \{R_3\}; 3; A_{36}, A_{10}, A_{36}$ ;	TP;
$U$ ; ML; $\sigma_{d1}, \mathcal{T}\sigma_h$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$P$ ; KH; $C_3^+, \sigma_{d1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 3; A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
	$\{R_2\}, \{R_3\}; 3; A_{36}, A_{10}$ ;	TP;
$T$ ; $\Gamma K$ ; $C_{22}'', \sigma_{d2}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
$S$ ; AH; $C_{22}'', \sigma_{d2}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
$T'$ ; MK; $C_{21}'', \sigma_{d1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
$S'$ ; LH; $C_{21}'', \sigma_{d1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3$ ;	P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $\sigma_h, \mathcal{T}\sigma_{d1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;
$R$ ; AL; $\sigma_h, \mathcal{T}\sigma_{d1}$ ;	$\{R_1\}, \{R_2\}; 2; \sigma_3, \sigma_0$ ;	P-WNL;

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{d1}, S_3^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{36}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{36}$ ;	TP;
$U$ ; ML; $\sigma_{d1}, \mathcal{T}\sigma_h$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$P$ ; KH; $C_3^+, \sigma_{d1}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}$ ;	TP;
$T$ ; $\Gamma K$ ; $C_{22}'', \sigma_{d2}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$T'$ ; MK; $C_{21}'', \sigma_{d1}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $\sigma_h, \mathcal{T}\sigma_{d1}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;

SG 191

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_5\}$ ; 3; $A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	QTP;	
	$\{R_1\}, \{R_6\}$ ; 3; $A_{39}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;	
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;	
	$\{R_2\}, \{R_5\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	QTP;	
	$\{R_2\}, \{R_6\}$ ; 3; $A_{39}, A_{10}, A_{13}$ ;	TP;	
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_3\}, \{R_5\}$ ; 3; $A_{40}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;	
	$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	QTP;	
	$\{R_4\}, \{R_5\}$ ; 3; $A_{40}, A_{10}, A_{13}$ ;	TP;	
	$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, A_{10}, A_{13}$ ;	QTP;	
	$\{R_5\}, \{R_6\}$ ; 4; $\frac{\Gamma_{3,0} + i\sqrt{3}\Gamma_{0,2}}{-2}, \Gamma_{0,3}, -\Gamma_{0,0}$ ;	DP;	0
$U$ ; $ML$ ; $C_{2,\sigma_{v1}}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;	
	$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	TP;	
$T$ ; $\Gamma K$ ; $C_{22}^{\prime\prime}, \sigma_{d2}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
$S$ ; $AH$ ; $C_{22}^{\prime\prime}, \sigma_{d2}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
$T'$ ; $MK$ ; $C_{21}^{\prime\prime}, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	

$$\begin{aligned}
& S'; \text{ LH}; C_{21, \sigma_{d1}, I\mathcal{T}}''; \{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0; \text{ P-WNLs}; \\
& \quad \{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0; \text{ P-WNLs}; \\
& \Sigma; \text{ GM}; C_{21, \sigma_{v1}, I\mathcal{T}}'; \{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0; \text{ P-WNLs}; \\
& \quad \{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0; \text{ P-WNLs}; \\
& R; \text{ AL}; C_{21, \sigma_{v1}, I\mathcal{T}}'; \{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0; \text{ P-WNLs}; \\
& \quad \{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0; \text{ P-WNL}; \\
& \quad \{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0; \text{ P-WNLs};
\end{aligned}$$

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;		P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	QTP;
	$\{R_1\}, \{R_6\}$ ; 3; $A_{39}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	QTP;
	$\{R_2\}, \{R_6\}$ ; 3; $A_{39}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $A_{40}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	QTP;
	$\{R_4\}, \{R_5\}$ ; 3; $A_{40}, A_{10}, A_{13}$ ;	TP;
	$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, A_{10}, A_{13}$ ;	QTP;
	$\{R_5\}, \{R_6\}$ ; 4; $\frac{\Gamma_{3,0} + i\sqrt{3}\Gamma_{0,2}}{-2}, \Gamma_{0,3}, -\Gamma_{0,0}$ ;	DP; 0
$U$ ; $ML$ ; $C_{2, \sigma_{v1}}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;		P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;		P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$T$ ; $\Gamma K$ ; $C_{22}^{\prime\prime}, \sigma_{d2}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;		P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$T'$ ; $MK$ ; $C_{21}^{\prime\prime}, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;		P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $C_{21}^{\prime}, \sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;		P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_5\}$ ;	3; $A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	QTP;	
	$\{R_1\}, \{R_6\}$ ;	3; $A_{39}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;	
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;	
	$\{R_2\}, \{R_5\}$ ;	3; $A_{36}, A_{10}, A_{13}$ ;	QTP;	
	$\{R_2\}, \{R_6\}$ ;	3; $A_{39}, A_{10}, A_{13}$ ;	TP;	
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_3\}, \{R_5\}$ ;	3; $A_{40}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;	
	$\{R_3\}, \{R_6\}$ ;	3; $A_{24}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	QTP;	
	$\{R_4\}, \{R_5\}$ ;	3; $A_{40}, A_{10}, A_{13}$ ;	TP;	
	$\{R_4\}, \{R_6\}$ ;	3; $A_{24}, A_{10}, A_{13}$ ;	QTP;	
	$\{R_5\}, \{R_6\}$ ;	4; $\frac{\Gamma_{3,0} + i\sqrt{3}\Gamma_{0,2}}{-2}, \Gamma_{0,3}, -\Gamma_{0,0}$ ;	DP;	0
$U$ ; $ML$ ; $C_{2,\sigma_{v1}}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;	
	$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, A_{10}, A_{13}$ ;	TP;	
$T$ ; $\Gamma K$ ; $C_{22}'', \sigma_{d2}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
$S$ ; $AH$ ; $C_{22}'', \sigma_{d2}, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP;	0
$T'$ ; $MK$ ; $C_{21}'', \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
$S'$ ; $LH$ ; $C_{21}'', \sigma_{d1}, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP;	0
$\Sigma$ ; $\Gamma M$ ; $C_{21}', \sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;	
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;	
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;	

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_6\}$ ;	3; $A_{36}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	QTP;
	$\{R_2\}, \{R_3\}$ ;	3; $A_{39}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_6\}$ ;	3; $A_{36}, A_{10}, A_{13}$ ;	QTP;
	$\{R_3\}, \{R_4\}$ ;	3; $A_{39}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_5\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_6\}$ ;	3; $A_{40}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ;	3; $A_{24}, \frac{1}{3}(A_0 + 2\sqrt{3}A_8), A_{13}$ ;	QTP;
	$\{R_4\}, \{R_6\}$ ;	3; $A_{40}, A_{10}, A_{13}$ ;	TP;
	$\{R_5\}, \{R_6\}$ ;	3; $A_{24}, A_{10}, A_{13}$ ;	QTP;
		4; $\frac{\Gamma_{3,0} + i\sqrt{3}\Gamma_{0,2}}{-2}, \Gamma_{0,3}, -\Gamma_{0,0}$ ;	DP; 0
$U$ ; $ML$ ; $C_{2,\sigma_{v1}}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_5\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0 + 2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_4\}$ ;	3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$T$ ; $\Gamma K$ ; $C_{22}^{\prime\prime}, \sigma_{d2}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_5\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$T'$ ; $MK$ ; $C_{21}^{\prime\prime}, \sigma_{d1}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_5\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $C_{21}^{\prime}, \sigma_{v1}, IT$ ; $\{R_1\}, \{R_2\}$ ;	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_5\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$R$ ; $AL$ ; $\sigma_h, \sigma_{v1}, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;		2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP; 0



## SG 195

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$Z$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T$ ; $MR$ ; $C_{2z}, \mathcal{T}C_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

## SG 196

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$Z$ ; $XW$ ; $C_{2x}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

## SG 197

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma H$ ; $C_{2y}, \mathcal{T}C_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma P$ ; $C_{31}^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$D$ ; $NP$ ; $C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1
$F$ ; $PH$ ; $C_{34}^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1

## SG 198

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$T$ ; $MR$ ; $C_{2z}, \mathcal{T}C_{2x}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	C-2 DP; 2

SG 199

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma\text{H}$ ; $C_{2y}, \mathcal{T}C_{2x}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma\text{P}$ ; $C_{31}^+$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3)$ ;	C-1 WP; 1
$D$ ; $\text{NP}$ ; $C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1
$F$ ; $\text{PH}$ ; $C_{34}^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{(\sqrt{3}+i)\sigma_0 + (\sqrt{3}-3i)\sigma_3}{4}$ ;	C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_3 - i\sigma_0)$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{14}$ ;	C-1 WP; 1

SG 200

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma\text{X}$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma\text{M}$ ; $\sigma_z, I\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma\text{R}$ ; $C_{31}^+, I\mathcal{T}$ ; $\{R_1\}, \{R_2, R_3\}$ ; 3; $A_{33}, A_{17}$ ;	TP;
$S$ ; $\text{XR}$ ; $\sigma_y, I\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;
$Z$ ; $\text{XM}$ ; $C_{2x}, \sigma_z, I\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$T$ ; $\text{MR}$ ; $C_{2x}, \sigma_y, I\mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

## SG 201

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, IT$ ; $\{R_1\}, \{R_2, R_3\}$ ;	3; $A_{33}, A_{17}$ ;	TP;
$S$ ; $XR$ ; $\sigma_y, IT$ ; $\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$T$ ; $MR$ ; $\sigma_y, C_{2z}, IT$ ; $\{R_2\}, \{R_4\}$ ;	2; $-i\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
$\{R_2\}, \{R_6\}$ ;	2; $-i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_8\}$ ;	2; $-i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_4\}, \{R_6\}$ ;	2; $i\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_4\}, \{R_8\}$ ;	2; $i\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_6\}, \{R_8\}$ ;	2; $-i\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;

## SG 202

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, IT$ ; $\{R_1\}, \{R_2, R_3\}$ ;	3; $A_{33}, A_{17}$ ;	TP;
$\Sigma$ ; $\Gamma \Sigma$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$S$ ; $XS$ ; $\sigma_y, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$Z$ ; $XW$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;

## SG 203

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, IT$ ; $\{R_1\}, \{R_2, R_3\}$ ;	3; $A_{33}, A_{17}$ ;	TP;
$\Sigma$ ; $\Gamma \Sigma$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$S$ ; $XS$ ; $\sigma_y, IT$ ; $\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;

## SG 204

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma N$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma H$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma P$ ; $C_{31}^+, IT$ ; $\{R_1\}, \{R_2, R_3\}$ ;	3; $A_{33}, A_{17}$ ;	TP;
$D$ ; $NP$ ; $C_{2z}, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$G$ ; $HN$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $PH$ ; $C_{34}^+, IT$ ; $\{R_1\}, \{R_2, R_3\}$ ;	3; $A_{33}, A_{17}$ ;	TP;

## SG 205

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Sigma$ ; $\Gamma M$ ; $\sigma_z, IT$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, IT$ ; $\{R_1\}, \{R_2, R_3\}$ ;	3; $A_{33}, A_{17}$ ;	TP;
$Z$ ; $XM$ ; $C_{2x}, \sigma_z, IT$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	4; $\Gamma_{0,3}, \Gamma_{3,0}, \Gamma_{0,1}$ ;	DP;

0

SG 206

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma\text{N}$ ; $\sigma_z, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma\text{H}$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma\text{P}$ ; $C_{31}^+, I\mathcal{T}$ ;	$\{R_1\}, \{R_2, R_3\}$ ;	3; $A_{33}, A_{17}$ ;	TP;
$G$ ; $\text{HN}$ ; $\sigma_z, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $-i\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $\text{PH}$ ; $C_{34}^+, I\mathcal{T}$ ;	$\{R_2, R_6\}, \{R_4\}$ ;	3; $\frac{\sqrt{3}(A_5 - iA_8)}{2}, A_{20}$ ;	TP;

SG 207

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma\text{X}$ ; $C_{4y}^+, C_{2c}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_1\}, \{R_4\}$ ;	2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_3\}$ ;	2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_3\}, \{R_4\}$ ;	2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma\text{M}$ ; $C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma\text{R}$ ; $C_{31}^+, C_{2e}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_3\}$ ;	2; $\frac{(1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_3\}$ ;	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$S$ ; $\text{XR}$ ; $C_{2c}, C_{2e}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Z$ ; $\text{XM}$ ; $C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T$ ; $\text{MR}$ ; $C_{4z}^+, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_1\}, \{R_4\}$ ;	2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_3\}$ ;	2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_3\}, \{R_4\}$ ;	2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1

SG 208

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, C_{2c}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, C_{2e}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$S$ ; $XR$ ; $C_{2c}, C_{2e}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Z$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T$ ; $MR$ ; $C_{4z}^+, E, \mathcal{T}C_{2y}$ ;	$\{R_5\}, \{R_6\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0, \sigma_0$ ;	C-1 WP; 1
	$\{R_5\}, \{R_7\}$ ; 2; $-\sigma_3, \sigma_0, \sigma_0$ ;	C-2 WP; 2
	$\{R_5\}, \{R_8\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0, \sigma_0$ ;	C-1 WP; 1
	$\{R_6\}, \{R_7\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0, \sigma_0$ ;	C-1 WP; 1
	$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, \sigma_0, \sigma_0$ ;	C-2 WP; 2
	$\{R_7\}, \{R_8\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0, \sigma_0$ ;	C-1 WP; 1

SG 209

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, C_{2c}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, C_{2e}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma \Sigma$ ; $C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S$ ; $XS$ ; $C_{2c}, C_{2e}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Z$ ; $XW$ ; $C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Q$ ; $LW$ ; $C_{2f}$ ;	$\{R_4\}, \{R_8\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, C_{2c} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, C_{2e} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1 + \sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1} - 1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma \Sigma$ ; $C_{2a}, C_{2b} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S$ ; $XS$ ; $C_{2c}, C_{2e} \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Z$ ; $XW$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Q$ ; $LW$ ; $C_{2f}$ ; $\{R_4\}, \{R_8\}$ ; 2; $\sigma_3$ ;	C-1 WP; 1

## SG 211

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma N$ ; $C_{2a}, C_{2b} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Delta$ ; $\Gamma H$ ; $C_{4y}^+, C_{2c} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ; 2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ; 2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma P$ ; $C_{31}^+, C_{2e} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$D$ ; $NP$ ; $C_{2z}, C_{2b} \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$G$ ; $HN$ ; $C_{2b}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$F$ ; $PH$ ; $C_{34}^+, C_{2e} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ; 2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ; 2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1

## SG 212

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, C_{2c} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $(\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_1\}, \{R_4\}$ ;	2; $(\frac{1}{2} - \frac{i}{2})(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ;	2; $(-\frac{1}{2} + \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-2 WP; 2
$\{R_3\}, \{R_4\}$ ;	2; $(-\frac{1}{2} - \frac{i}{2})(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, C_{2e} \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ;	2; $-\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\{R_1\}, \{R_3\}$ ;	2; $\frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_3\}$ ;	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$T$ ; $MR$ ; $C_{4z}^+, E, \mathcal{T}C_{2y}$ ; $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4; $-\frac{(1+i)(\Gamma_{0,3}-i\Gamma_{3,3})}{2}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ;		C-2 DP; 2



SG 213

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, C_{2c}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	$2; \left(\frac{1}{2} + \frac{i}{2}\right)(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_3\}$ ;	$2; \sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_1\}, \{R_4\}$ ;	$2; \left(\frac{1}{2} - \frac{i}{2}\right)(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_3\}$ ;	$2; \left(-\frac{1}{2} + \frac{i}{2}\right)(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_3\}, \{R_4\}$ ;	$2; \left(-\frac{1}{2} - \frac{i}{2}\right)(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	$2; \sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, C_{2e}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	$2; -\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_3\}$ ;	$2; \frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_3\}$ ;	$2; \frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$T$ ; $MR$ ; $C_{4z}^+, E, \mathcal{T}C_{2y}$ ;	$\{R_5, R_7\}, \{R_6, R_8\}$ ;	$4; -\frac{(1+i)(\Gamma_{0,3}-i\Gamma_{3,3})}{2}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ;	C-2 DP; 2

SG 214

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma N$ ; $C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	$2; \sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Delta$ ; $\Gamma H$ ; $C_{4y}^+, C_{2c}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	$2; \left(\frac{1}{2} + \frac{i}{2}\right)(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_3\}$ ;	$2; \sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_1\}, \{R_4\}$ ;	$2; \left(\frac{1}{2} - \frac{i}{2}\right)(\sigma_0 + i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_3\}$ ;	$2; \left(-\frac{1}{2} + \frac{i}{2}\right)(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_3\}, \{R_4\}$ ;	$2; \left(-\frac{1}{2} - \frac{i}{2}\right)(\sigma_0 - i\sigma_3), \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma P$ ; $C_{31}^+, C_{2e}\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	$2; -\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
	$\{R_1\}, \{R_3\}$ ;	$2; \frac{(1+\sqrt[3]{-1})\sigma_3 - (\sqrt[3]{-1}-1)\sigma_0}{2}, \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_3\}$ ;	$2; \frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0$ ;	C-1 WP; 1
$D$ ; $NP$ ; $C_{2z}, C_{2b}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; \sigma_3, \sigma_0$ ;	C-1 WP; 1
$G$ ; $HN$ ; $C_{2b}, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; \sigma_3, \sigma_0$ ;	C-1 WP; 1
$F$ ; $PH$ ; $C_{34}^+, C_{2e}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; \frac{(\sqrt{3}+i)\sigma_0 + (\sqrt{3}-3i)\sigma_3}{4}, \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_6\}$ ;	$2; \frac{1}{2}(\sqrt{3}\sigma_3 - i\sigma_0), \sigma_0$ ;	C-1 WP; 1
	$\{R_4\}, \{R_6\}$ ;	$2; \sigma_{14}, \sigma_0$ ;	C-1 WP; 1

SG 215

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_{dc}, S_{4y}^+ \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3, R_4\}$ ; 3; $A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{19}$ ; TP;
$\{R_2\}, \{R_3, R_4\}$ ; 3; $A_{13}, A_{10}, A_{19}$ ; TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, \sigma_{db}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ; TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}$ ; TP;
$S$ ; $XR$ ; $\sigma_{de}, \mathcal{T}\sigma_{dc}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$Z$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1
$T$ ; $MR$ ; $C_{2z}, \sigma_{da}, S_{4z}^+ \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3, R_4\}$ ; 3; $A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{19}$ ; TP;
$\{R_2\}, \{R_3, R_4\}$ ; 3; $A_{13}, A_{10}, A_{19}$ ; TP;

SG 216

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_{dc}, S_{4y}^+ \mathcal{T}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ; P-WNLs;
$\{R_1\}, \{R_3, R_4\}$ ; 3; $A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{19}$ ; TP;
$\{R_2\}, \{R_3, R_4\}$ ; 3; $A_{13}, A_{10}, A_{19}$ ; TP;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, \sigma_{db}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ; TP;
$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}$ ; TP;
$\Sigma$ ; $\Gamma \Sigma$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$S$ ; $XS$ ; $\sigma_{de}, \mathcal{T}\sigma_{dc}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; P-WNL;
$Z$ ; $XW$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$ ; C-1 WP; 1

SG 217

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma N$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma H$ ; $C_{2y}, \sigma_{de}, S_{4y}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{19}$ ;	TP;
	$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$\Lambda$ ; $\Gamma P$ ; $C_{31}^+, \sigma_{db}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, A_{10}$ ;	TP;
$D$ ; $NP$ ; $C_{2z}, \sigma_{db}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3$ ;	P-WNLs;
$G$ ; $HN$ ; $\sigma_{da}, \mathcal{T}\sigma_{db}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; $PH$ ; $C_{34}^+, \sigma_{da}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, A_{10}$ ;	TP;

SG 218

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_{de}, S_{4y}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{19}$ ;	TP;
	$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, \sigma_{db}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, A_{10}$ ;	TP;
$Z$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T$ ; $MR$ ; $C_{2z}, \sigma_{da}, S_{4z}^+ \mathcal{T}$ ;	$\{R_1, R_2\}, \{R_3\}$ ;	3; $\frac{A_0+2\sqrt{3}A_8}{3}, A_{10}, -A_{16}$ ;	TP;
	$\{R_1, R_2\}, \{R_4\}$ ;	3; $\frac{A_0+2\sqrt{3}A_8}{3}, -A_{13}, -A_{16}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;

SG 219

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_{dc}, S_{4y}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{19}$ ;	TP;
	$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, \sigma_{db}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, A_{10}$ ;	TP;
$\Sigma$ ; $\Gamma \Sigma$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$S$ ; $XS$ ; $\sigma_{de}, \mathcal{T}\sigma_{dc}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $-\sigma_3, \sigma_0$ ;	P-WNL;
$Z$ ; $XW$ ; $C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	C-1 WP; 1

SG 220

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma N$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma H$ ; $C_{2y}, \sigma_{de}, S_{4y}^+ \mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3, R_4\}$ ;	3; $A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{19}$ ;	TP;
	$\{R_2\}, \{R_3, R_4\}$ ;	3; $A_{13}, A_{10}, A_{19}$ ;	TP;
$\Lambda$ ; $\Gamma P$ ; $C_{31}^+, \sigma_{db}$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, A_{10}$ ;	TP;
$F$ ; $PH$ ; $C_{34}^+, \sigma_{da}$ ;	$\{R_3\}, \{R_4\}$ ;	2; $i\sigma_0, -(-1)^{3/4}\sigma_3$ ;	P-WNLs;
	$\{R_3\}, \{R_6\}$ ;	3; $-iA_{24}, -\frac{(-1)^{3/4}(A_0+2\sqrt{3}A_8)}{3}$ ;	TP;
	$\{R_4\}, \{R_6\}$ ;	3; $-iA_{24}, \frac{(1-i)A_{10}}{\sqrt{2}}$ ;	TP;

## SG 221

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}, A_{13}$	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}, A_{13}$	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, \sigma_{db}, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}; 3; A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$	TP;
	$\{R_2\}, \{R_3\}; 3; A_{36}, A_{10}, A_{13}$	TP;
$S$ ; $XR$ ; $C_{2c}, \sigma_y, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
$Z$ ; $XM$ ; $C_{2x}, \sigma_z, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
$T$ ; $MR$ ; $C_{4z}^+, \sigma_y, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0$	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0$	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}, A_{13}$	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}, A_{13}$	TP;

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, \sigma_{db}, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$T$ ; $MR$ ; $C_{4z}^+, C_{2z}, \sigma_{da}, I\mathcal{T}$ ;	$\{R_5\}, \{R_6\}$ ; 2; $i\sigma_3, -\sigma_0, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, -\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_0, -\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_9\}$ ; 3; $A_{30}, -A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{32}$ ;	TP;
	$\{R_6\}, \{R_7\}$ ; 2; $-i\sigma_0, -\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, -\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}$ ; 3; $A_{31}, -A_{13}, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{32}$ ;	TP;
	$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_3, -\sigma_0, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}$ ; 3; $A_{31}, -A_{13}, -A_{10}, A_{32}$ ;	TP;
	$\{R_8\}, \{R_9\}$ ; 3; $A_{30}, -A_{13}, -A_{10}, A_{32}$ ;	TP;

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ;	3; $A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ;	3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ;	3; $-A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ;	3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, \sigma_{db}, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$Z$ ; $XM$ ; $C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$T$ ; $MR$ ; $C_{4z}^+, \sigma_x, E, IT$ ;	$\{R_6\}, \{R_{10}\}$ ;	3; $-A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_0, A_{13}$ ;	TP;
	$\{R_6\}, \{R_7\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ;	2; $-\sigma_3, \sigma_0, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_9\}$ ;	2; $-\sigma_3, \sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_{10}\}$ ;	3; $-A_{29}, A_{10}, A_0, A_{13}$ ;	TP;
	$\{R_7\}, \{R_8\}$ ;	2; $-\sigma_3, -\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_9\}$ ;	2; $-\sigma_3, -\sigma_0, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_8\}, \{R_{10}\}$ ;	3; $A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_0, A_{13}$ ;	TP;
	$\{R_8\}, \{R_9\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_9\}, \{R_{10}\}$ ;	3; $A_{19}, A_{10}, A_0, A_{13}$ ;	TP;

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ;	3; $A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ;	3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ;	3; $-A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ;	3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$\Lambda$ ; $\Gamma R$ ; $C_{31}^+, \sigma_{db}, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$S$ ; $XR$ ; $C_{2c}, \sigma_{de}, IT$ ;	$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_6\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_8\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_6\}$ ;	2; $-\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_4\}, \{R_8\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$T$ ; $MR$ ; $\sigma_x, C_{2z}, \sigma_{db}, IT$ ;	$\{R_5\}, \{R_{10}\}$ ;	3; $A_{37}, A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{32}$ ;	TP;
	$\{R_5\}, \{R_6\}$ ;	2; $-i\sigma_3, \sigma_0, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ;	2; $-i\sigma_3, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_5\}, \{R_8\}$ ;	2; $-i\sigma_0, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_{10}\}$ ;	3; $A_{38}, A_{13}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{32}$ ;	TP;
	$\{R_6\}, \{R_7\}$ ;	2; $i\sigma_0, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_6\}, \{R_8\}$ ;	2; $i\sigma_3, \sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_7\}, \{R_{10}\}$ ;	3; $A_{38}, A_{13}, A_{10}, A_{32}$ ;	TP;
	$\{R_7\}, \{R_8\}$ ;	2; $i\sigma_3, \sigma_0, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_8\}, \{R_{10}\}$ ;	3; $A_{37}, A_{13}, A_{10}, A_{32}$ ;	TP;



$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, IT$	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$	TP;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, \sigma_{db}, IT$	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$	TP;
	$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$	TP;
$\Sigma$ ; $\Gamma \Sigma$ ; $C_{2a}, \sigma_z, IT$	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
$S$ ; $XS$ ; $C_{2c}, \sigma_y, IT$	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
$Z$ ; $XW$ ; $C_{2x}, \sigma_z, IT$	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$	P-WNLs;
$Q$ ; $LW$ ; $C_{2f}, IT$	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_3, \sigma_0$	P-WNL;

$\Delta$ ; $\Gamma X$ ;	$C_{4y}^+, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_5\}$ ;	3; $A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
		$\{R_2\}, \{R_5\}$ ;	3; $A_{29}, A_{10}, A_{13}$ ;	TP;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_3\}, \{R_5\}$ ;	3; $-A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
		$\{R_4\}, \{R_5\}$ ;	3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$\Lambda$ ; $\Gamma L$ ;	$C_{31}^+, \sigma_{db}, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
		$\{R_2\}, \{R_3\}$ ;	3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$\Sigma$ ; $\Gamma \Sigma$ ;	$C_{2a}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $XS$ ;	$C_{2c}, \sigma_y, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
$Z$ ; $XW$ ;	$C_{2x}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ;	2; $\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;
		$\{R_1\}, \{R_3\}$ ;	2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_1\}, \{R_4\}$ ;	2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_3\}$ ;	2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
		$\{R_2\}, \{R_4\}$ ;	2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
		$\{R_3\}, \{R_4\}$ ;	2; $-\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNLs;

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, \sigma_{db}, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$\Sigma$ ; $\Gamma \Sigma$ ; $C_{2a}, \sigma_z, IT$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $XS$ ; $\sigma_y, \sigma_{de}, IT$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_6\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_8\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_4\}, \{R_6\}$ ; 2; $-\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_4\}, \{R_8\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_6\}, \{R_8\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
$Q$ ; $LW$ ; $C_{2f}, IT$ ;	$\{R_4\}, \{R_8\}$ ; 2; $\sigma_3, \sigma_0$ ;	P-WNL;

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^+, \sigma_{db}, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	TP;
$\Sigma$ ; $\Gamma \Sigma$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
$S$ ; $X S$ ; $\sigma_y, \sigma_{de}, I\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $-\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_6\}$ ; 2; $-\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_8\}$ ; 2; $-\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_4\}, \{R_6\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_4\}, \{R_8\}$ ; 2; $\sigma_0, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_6\}, \{R_8\}$ ; 2; $-\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;

## Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma\text{N}$ ; $C_{2a,\sigma_z,IT}$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
$\Delta$ ; $\Gamma\text{H}$ ; $C_{4y}^+, \sigma_x, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_5\}; 3; A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13};$	TP;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNLs;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNLs;
	$\{R_2\}, \{R_5\}; 3; A_{29}, A_{10}, A_{13};$	TP;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_3\}, \{R_5\}; 3; -A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13};$	TP;
	$\{R_4\}, \{R_5\}; 3; -A_{19}, A_{10}, A_{13};$	TP;
$\Lambda$ ; $\Gamma\text{P}$ ; $C_{31}^+, \sigma_{db}, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 3; A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13};$	TP;
	$\{R_2\}, \{R_3\}; 3; A_{36}, A_{10}, A_{13};$	TP;
$D$ ; $\text{NP}$ ; $C_{2z}, \sigma_{db}, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
$G$ ; $\text{HN}$ ; $C_{2b}, \sigma_{da}, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 2; \sigma_3, \sigma_0, \sigma_0;$	P-WNL;
	$\{R_1\}, \{R_4\}; 2; \sigma_3, \sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_3\}; 2; \sigma_3, -\sigma_3, \sigma_0;$	P-WNL;
	$\{R_2\}, \{R_4\}; 2; \sigma_3, -\sigma_0, \sigma_0;$	P-WNL;
	$\{R_3\}, \{R_4\}; 2; -\sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
$F$ ; $\text{PH}$ ; $C_{34}^+, \sigma_{da}, IT$	$\{R_1\}, \{R_2\}; 2; \sigma_0, \sigma_3, \sigma_0;$	P-WNLs;
	$\{R_1\}, \{R_3\}; 3; A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13};$	TP;
	$\{R_2\}, \{R_3\}; 3; A_{36}, A_{10}, A_{13};$	TP;

$\Sigma$ ; $\Gamma\text{N}$ ; $C_{2a,\sigma_z}, I\mathcal{T}$ ;	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNL;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 2; $\sigma_3, \sigma_0, \sigma_0$ ;	P-WNLs;
$\Delta$ ; $\Gamma\text{H}$ ; $C_{4y}^+, \sigma_x, I\mathcal{T}$ ;	$\{R_1\}, \{R_4\}$ ; 2; $\sigma_3, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_5\}$ ; 3; $A_{29}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_2\}, \{R_3\}$ ; 2; $\sigma_3, -\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_3, -\sigma_0, \sigma_0$ ;	P-WNLs;
	$\{R_2\}, \{R_5\}$ ; 3; $A_{29}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_5\}$ ; 3; $-A_{19}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
	$\{R_4\}, \{R_5\}$ ; 3; $-A_{19}, A_{10}, A_{13}$ ;	TP;
	$\{R_1\}, \{R_2\}$ ; 2; $\sigma_0, \sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_1\}, \{R_3\}$ ; 3; $A_{36}, \frac{A_0+2\sqrt{3}A_8}{3}, A_{13}$ ;	TP;
$\Lambda$ ; $\Gamma\text{P}$ ; $C_{31}^+, \sigma_{db}, I\mathcal{T}$ ;	$\{R_2\}, \{R_3\}$ ; 3; $A_{36}, A_{10}, A_{13}$ ;	TP;
	$\{R_3\}, \{R_4\}$ ; 2; $i\sigma_0, -(-1)^{3/4}\sigma_3, \sigma_0$ ;	P-WNLs;
	$\{R_3\}, \{R_6\}$ ; 3; $-iA_{24}, \frac{-(-1)^{3/4}(A_0+2\sqrt{3}A_8)}{3}, A_{13}$ ;	TP;
$F$ ; $\text{PH}$ ; $C_{34}^+, \sigma_{da}, I\mathcal{T}$ ;	$\{R_4\}, \{R_6\}$ ; 3; $-iA_{24}, \frac{(1-i)A_{10}}{\sqrt{2}}, A_{13}$ ;	TP;

## C. Effective Hamiltonian of both essential and accidental degeneracies

### 1. Notes to Sec. S7C

- (i) The top and bottom part of the tables in Sec. S7C lists the essential and accidental degeneracy, respectively.
- (ii) For each table in Sec. S7C, the first two lines present the SG number, the BZ type, the generating elements of the type II MSG (translations are not included here), whether centrosymmetry is contained in the group, and whether SOC is considered.
- (iii) Below the first two lines, the columns from left to right (separated by the semicolons) are the high-symmetry momentum  $\mathbf{k}$ , the corep and the effective Hamiltonian of the symmetry-protected degeneracies.
- (iv) In effective Hamiltonian, we use Roman letters (such as  $c_i$  and  $c_{i,j}$ ) and Greek letter (such as  $\alpha_i$ ) to denote the real and complex parameters, respectively.
- (v) We do not list the type II MSGs that do not exhibit symmetry-protected degeneracies at high-symmetry point and high-symmetry line.

### 2. SG 1-10

## SG 3

---

 $\Gamma_m; \{C_{2z}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 


---

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \\ V; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \\ W; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \\ U; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \end{aligned}$$

## SG 4

---

 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned} Z; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\ C; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\ D; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\ E; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \end{aligned}$$

---

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \\ V; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \\ W; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \\ U; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \end{aligned}$$

## SG 5

---

 $\Gamma_m^b; \{C_{2z}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 


---

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \\ U; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \end{aligned}$$



## SG 7

---

 $\Gamma_m; \{\sigma_z | \frac{1}{2}00\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$B; \{R_2, R_4\}; c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_3;$$

$$D; \{R_2, R_4\}; c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_3;$$

$$A; \{R_2, R_4\}; c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_3;$$

$$E; \{R_2, R_4\}; c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_3;$$

$$V; \{R_1, R_1\}; (c_1 + c_2k_z)\sigma_0 + \sum_{i=1}^3 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);$$

$$U; \{R_1, R_1\}; (c_1 + c_2k_z)\sigma_0 + \sum_{i=1}^3 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);$$

## SG 9

---

 $\Gamma_m^b; \{\sigma_z | \frac{1}{2}00\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$A; \{R_2, R_4\}; c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_3;$$

$$M; \{R_2, R_4\}; c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_3;$$

$$U; \{R_1, R_1\}; (c_1 + c_2k_z)\sigma_0 + \sum_{i=1}^3 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);$$

## SG 10

---

 $\Gamma_m; \{C_{2z}|000\}, \{I|000\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 


---

Accidental degeneracies on high symmetry line

$$\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$$

$$V; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$$

$$W; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$$

$$U; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$$

## SG 11

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 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \{I|00\frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 
 $Z; R_5; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $C; R_5; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $D; R_5; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $E; R_5; c_1\sigma_0 + c_2\sigma_2k_z;$ 


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 Accidental degeneracies on high symmetry line

 $\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$ 
 $V; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$ 
 $W; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$ 
 $U; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$ 

## SG 12

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 $\Gamma_m^b; \{C_{2z}|000\}, \{I|000\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 


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 Accidental degeneracies on high symmetry line

 $\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$ 
 $U; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$ 

## SG 13

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 $\Gamma_m; \{C_{2z}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 
 $B; R_5; c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2;$ 
 $D; R_5; c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2;$ 
 $A; R_5; c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2;$ 
 $E; R_5; c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2;$ 
 $V; \{R_1, R_2\}; (c_1 + c_2k_z)\sigma_0 + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);$ 
 $U; \{R_1, R_2\}; (c_1 + c_2k_z)\sigma_0 + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);$ 


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 Accidental degeneracies on high symmetry line

 $\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$ 
 $W; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$

SG 14

 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \{I|\frac{1}{2}0\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
B; R_5; & \quad c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2; \\
Z; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
C; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
D; \{R_2, R_4\}; & \quad h + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y)k_z; \\
& \quad \{R_6, R_8\}; h + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y)k_z; \\
A; R_5; & \quad c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2; \\
E; \{R_2, R_4\}; & \quad h + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y)k_z; \\
& \quad \{R_6, R_8\}; h + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y)k_z; \\
V; \{R_1, R_2\}; & \quad (c_1 + c_2k_z)\sigma_0 + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y); \\
U; \{R_1, R_2\}; & \quad (c_1 + c_2k_z)\sigma_0 + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);
\end{aligned}$$

Here,  $h = (c_1 + c_2k_x^2 + c_3k_y^2 + c_4k_xk_y + c_5k_z^2)\sigma_0$ .

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y); \\
W; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);
\end{aligned}$$

SG 15

 $\Gamma_m^b; \{C_{2z}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
A; R_5; & \quad c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2; \\
M; R_5; & \quad c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2; \\
U; \{R_1, R_2\}; & \quad (c_1 + c_2k_z)\sigma_0 + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\Lambda; \{R_1\}, \{R_2\}; \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$$

SG 16

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\Lambda;$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z; \\
D; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z; \\
B; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
C; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
E; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
A; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
H; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
Q; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
G; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x;
\end{aligned}$$

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SG 17

$\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$$\begin{aligned}
Z; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
U; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
T; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
D; & \\
P; \{R_1, R_2\}; & (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
B; \{R_1, R_2\}; & (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
E; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
A; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z; \\
D; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
C; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
H; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
Q; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
G; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x;
\end{aligned}$$

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
U; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
T; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
S; \{R_2, R_4\}; & (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
& \{R_6, R_8\}; (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
R; \{R_2, R_4\}; & (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
& \{R_6, R_8\}; (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
D; \{R_2, R_4\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
P; \{R_2, R_4\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
C; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
E; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
H; \{R_1, R_2\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
Q; \{R_1, R_1\}; & (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_x k_y; \\
& \{R_2, R_2\}; (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_x k_y; \\
G; \{R_1, R_2\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
B; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
A; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
Q; \{R_1, R_1\}, \{R_2, R_2\}; & \Gamma_{0,0} (c_1 + c_2k_z) + c_3\Gamma_{3,0}k_z + c_4\Gamma_{1,0}k_y + c_5\Gamma_{2,0}k_x + \sum_{i=1}^3 (c_{i,1}k_x\Gamma_{1,i} + c_{i,2}k_y\Gamma_{2,i});
\end{aligned}$$

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 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Y; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_x; \\
Z; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
U; \{R_2, R_4\}; & \quad (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_z; \\
& \quad \{R_6, R_8\}; (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_z; \\
T; \{R_2, R_4\}; & \quad (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_yk_z; \\
& \quad \{R_6, R_8\}; (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_yk_z; \\
S; \{R_2, R_4\}; & \quad (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
& \quad \{R_6, R_8\}; (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
R; \{R_5, R_5\}; & \quad c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_x + c_3\Gamma_{0,1}k_y + c_4\Gamma_{0,2}k_z; \\
D; \{R_2, R_4\}; & \quad (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
P; \{R_2, R_2\}; & \quad (c_1 + c_2k_y + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_x k_z; \\
& \quad \{R_4, R_4\}; (c_1 + c_2k_y + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_x k_z; \\
B; \{R_1, R_2\}; & \quad (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 - c_4\sigma_2)k_z; \\
\Sigma; & \\
C; \{R_1, R_2\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
E; \{R_2, R_2\}; & \quad (c_1 + c_2k_x + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_y k_z; \\
& \quad \{R_4, R_4\}; (c_1 + c_2k_x + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_y k_z; \\
A; \{R_2, R_4\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
H; \{R_2, R_4\}; & \quad (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
Q; \{R_2, R_2\}; & \quad (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_x k_y; \\
& \quad \{R_4, R_4\}; (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_x k_y; \\
G; \{R_1, R_2\}; & \quad (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
P; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2k_y) + c_3\Gamma_{3,0}k_y + c_4\Gamma_{2,0}k_x + c_5\Gamma_{1,0}k_z + \sum_{i=1}^3 (c_{i,1}k_x\Gamma_{1,i} + c_{i,2}k_z\Gamma_{2,i}); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
E; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2k_x) + c_3\Gamma_{3,0}k_x + c_4\Gamma_{1,0}k_y + c_5\Gamma_{2,0}k_z + \sum_{i=1}^3 (c_{i,1}k_z\Gamma_{1,i} + c_{i,2}k_y\Gamma_{2,i}); \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
Q; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2k_z) + c_3\Gamma_{3,0}k_z + c_4\Gamma_{1,0}k_y + c_5\Gamma_{2,0}k_x + \sum_{i=1}^3 (c_{i,1}k_x\Gamma_{1,i} + c_{i,2}k_y\Gamma_{2,i});
\end{aligned}$$

SG 20

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 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 
 $Z; R_5; \quad c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $T; R_5; \quad c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $R; \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $A; \{R_1, R_2\}; (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z;$ 
 $\Delta;$ 
 $B; \{R_2, R_4\}; (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z;$ 
 $G; \{R_2, R_4\}; (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z;$ 
 $E; \{R_1, R_2\}; (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z;$ 


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 Accidental degeneracies on high symmetry line

 $\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x;$ 
 $H; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x;$ 
 $D; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);$ 
 $\Sigma; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;$ 
 $\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z;$ 
 $F; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z;$ 
 $C; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;$

SG 21

 $\Gamma_{o;}^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

Accidental degeneracies on high symmetry line

- $\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x;$   
 $H; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x;$   
 $D; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);$   
 $A; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;$   
 $\Sigma; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;$   
 $\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z;$   
 $B; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z;$   
 $G; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z;$   
 $F; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z;$   
 $E; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;$   
 $C; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;$

SG 22

 $\Gamma_{o;}^f; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

Accidental degeneracies on high symmetry line

- $\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x;$   
 $G; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x;$   
 $H; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x;$   
 $Q; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x;$   
 $\Sigma; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;$   
 $C; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;$   
 $A; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;$   
 $U; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;$   
 $\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z;$   
 $D; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z;$   
 $B; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z;$   
 $R; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z;$

SG 23

 $\Gamma_{o;}^v; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
G; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
P; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y); \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
F; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
D; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + \sum_{i=1}^2 \sigma_i(c_{i,1}k_y + c_{i,2}k_z); \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
U; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
Q; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_z);
\end{aligned}$$

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SG 24

$\Gamma_o^v; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$W; R_9; c_1\sigma_0 + c_2\sigma_2k_x + c_3\sigma_3k_y + c_4\sigma_1k_z;$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
G; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
P; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y); \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
F; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
D; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + \sum_{i=1}^2 \sigma_i(c_{i,1}k_y + c_{i,2}k_z); \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
U; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
Q; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_z);
\end{aligned}$$

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SG 25

$\Gamma_o; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
&D; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
&P; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
&B; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
&C; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
&E; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
&A; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&H; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&Q; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&G; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

SG 26

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 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 
 $Z; \{R_2, R_4\}; c_2\sigma_3k_z + c_1\sigma_0;$ 
 $\{R_6, R_8\}; c_2\sigma_3k_z + c_1\sigma_0;$ 
 $U; \{R_2, R_4\}; c_2\sigma_3k_z + c_1\sigma_0;$ 
 $\{R_6, R_8\}; c_2\sigma_3k_z + c_1\sigma_0;$ 
 $T; \{R_2, R_4\}; c_2\sigma_3k_z + c_1\sigma_0;$ 
 $\{R_6, R_8\}; c_2\sigma_3k_z + c_1\sigma_0;$ 
 $R; \{R_2, R_4\}; c_2\sigma_3k_z + c_1\sigma_0;$ 
 $\{R_6, R_8\}; c_2\sigma_3k_z + c_1\sigma_0;$ 
 $P; \{R_1, R_1\}; (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^3 c_{1,i}\sigma_i k_z;$ 
 $\{R_2, R_2\}; (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^3 c_{1,i}\sigma_i k_z;$ 
 $B; \{R_1, R_1\}; (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^3 c_{1,i}\sigma_i k_z;$ 
 $\{R_2, R_2\}; (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^3 c_{1,i}\sigma_i k_z;$ 
 $E; \{R_1, R_2\}; (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_z;$ 
 $A; \{R_1, R_2\}; (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_z;$

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Accidental degeneracies on high symmetry line

$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x;$
$D; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x;$
$P; \{R_1, R_1\}, \{R_2, R_2\};$	$\Gamma_{0,0} (c_1 + c_2 k_y) + c_3 \Gamma_{3,0} k_y + c_4 \Gamma_{1,0} k_x + \sum_{i=1}^3 (c_{i,1} \Gamma_{2,i} k_x + c_{i,2} \Gamma_{0,i} k_z + c_{i,3} \Gamma_{3,i} k_z);$
$B; \{R_1, R_1\}, \{R_2, R_2\};$	$\Gamma_{0,0} (c_1 + c_2 k_y) + c_3 \Gamma_{3,0} k_y + c_4 \Gamma_{1,0} k_x + \sum_{i=1}^3 (c_{i,1} \Gamma_{2,i} k_x + c_{i,2} \Gamma_{0,i} k_z + c_{i,3} \Gamma_{3,i} k_z);$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y;$
$C; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y;$
$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$H; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$Q; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$G; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$

SG 27

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 $\Gamma_o; \{C_{2z}|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 
 $Z; \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z;$ 
 $\{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z;$ 
 $U; \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z;$ 
 $\{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z;$ 
 $T; \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z;$ 
 $\{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z;$ 
 $R; \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z;$ 
 $\{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z;$ 
 $P; \{R_1, R_2\}; (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z;$ 
 $B; \{R_1, R_2\}; (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z;$ 
 $E; \{R_1, R_2\}; (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z;$ 
 $A; \{R_1, R_2\}; (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z;$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
&D; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
&C; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&H; \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&Q; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&G; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

SG 28

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 $\Gamma_o; \{C_{2z}|\frac{1}{2}00\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Y; R_5; & \quad c_2 \sigma_2 k_y + c_1 \sigma_0; \\
T; R_5; & \quad c_2 \sigma_2 k_y + c_1 \sigma_0; \\
S; R_5; & \quad c_2 \sigma_2 k_y + c_1 \sigma_0; \\
R; R_5; & \quad c_2 \sigma_2 k_y + c_1 \sigma_0; \\
\Delta; & \\
C; \{R_1, R_2\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y + c_5 \sigma_3 k_z; \\
E; \{R_1, R_2\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y + c_5 \sigma_3 k_z; \\
H; R_5; & (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y; \\
Q; R_5; & (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
D; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
P; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
B; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
A; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
G; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

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SG 29

 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_2 \sigma_2 k_y + c_1 \sigma_0; \\
Z; \{R_2, R_4\}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_6, R_8\}; c_2 \sigma_3 k_z + c_1 \sigma_0; \\
U; \{R_2, R_4\}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_6, R_8\}; c_2 \sigma_3 k_z + c_1 \sigma_0; \\
T; \{R_5, R_5\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,1} k_x + c_3 \Gamma_{0,3} k_y + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
S; R_5; & c_2 \sigma_2 k_y + c_1 \sigma_0; \\
R; \{R_5, R_5\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,1} k_x + c_3 \Gamma_{0,3} k_y + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
P; \{R_1, R_1\}; & (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
& \{R_2, R_2\}; (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
B; \{R_1, R_1\}; & (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
& \{R_2, R_2\}; (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
C; \{R_1, R_2\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y + c_4 \sigma_3 k_z; \\
E; \{R_1, R_1\}; & (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
& \{R_2, R_2\}; (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
A; \{R_1, R_2\}; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_3 k_z; \\
H; R_5; & (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y; \\
Q; R_5; & (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
D; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
P; \{R_1, R_1\}, \{R_2, R_2\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_y) + c_3 \Gamma_{3,0} k_y + c_4 \Gamma_{1,0} k_x + \sum_{i=1}^3 (c_{i,1} \Gamma_{2,i} k_x + c_{i,2} \Gamma_{0,i} k_z + c_{i,3} \Gamma_{3,i} k_z); \\
B; \{R_1, R_1\}, \{R_2, R_2\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_y) + c_3 \Gamma_{3,0} k_y + c_4 \Gamma_{1,0} k_x + \sum_{i=1}^3 (c_{i,1} \Gamma_{2,i} k_x + c_{i,2} \Gamma_{0,i} k_z + c_{i,3} \Gamma_{3,i} k_z); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
E; \{R_1, R_1\}, \{R_2, R_2\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + c_3 \Gamma_{3,0} k_x + c_4 \Gamma_{2,0} k_y + \sum_{i=1}^3 (c_{i,1} \Gamma_{1,i} k_y + c_{i,2} \Gamma_{0,i} k_z + c_{i,3} \Gamma_{3,i} k_z); \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
G; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

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SG 30

 $\Gamma_o; \{C_{2z} | \frac{1}{2} 00\}, \{\sigma_y | 00 \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Y; R_5; & \quad c_2 \sigma_2 k_y + c_1 \sigma_0; \\
Z; \{R_2, R_4\}; & \quad c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_6, R_8\}; \quad c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
U; \{R_2, R_4\}; & \quad c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_6, R_8\}; \quad c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
T; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_x; \\
S; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
R; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_x; \\
P; \{R_1, R_2\}; & \quad (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_x + c_5 \sigma_3 k_z; \\
B; \{R_1, R_2\}; & \quad (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_x + c_5 \sigma_3 k_z; \\
C; \{R_1, R_2\}; & \quad (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y + c_5 \sigma_3 k_z; \\
A; \{R_1, R_2\}; & \quad (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y + c_5 \sigma_3 k_z; \\
H; R_5; & \quad (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y; \\
Q; R_5; & \quad (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y;
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
&D; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
&E; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&G; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

SG 31

 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Y; R_5; & \quad c_2\sigma_2k_y + c_1\sigma_0; \\
Z; \{R_2, R_4\}; & \quad c_2\sigma_3k_z + c_1\sigma_0; \\
& \quad \{R_6, R_8\}; \quad c_2\sigma_3k_z + c_1\sigma_0; \\
U; \{R_2, R_4\}; & \quad c_2\sigma_3k_z + c_1\sigma_0; \\
& \quad \{R_6, R_8\}; \quad c_2\sigma_3k_z + c_1\sigma_0; \\
T; R_5; & \quad (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_y)k_z; \\
S; R_5; & \quad c_2\sigma_2k_y + c_1\sigma_0; \\
R; R_5; & \quad (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_y)k_z; \\
P; \{R_1, R_2\}; & \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_3k_z; \\
B; \{R_1, R_2\}; & \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_3k_z; \\
C; \{R_1, R_2\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
E; \{R_1, R_2\}; & \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_z; \\
A; \{R_1, R_1\}; & \quad (c_1 + c_2k_x)\sigma_0 + \sum_{i=1}^3 c_{i,1}\sigma_i k_z; \\
& \quad \{R_2, R_2\}; \quad (c_1 + c_2k_x)\sigma_0 + \sum_{i=1}^3 c_{i,1}\sigma_i k_z; \\
H; R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_x + c_4\sigma_1k_y; \\
Q; R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_x + c_4\sigma_1k_y;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2k_y) + c_3\sigma_3k_y + c_1\sigma_1k_x; \\
D; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2k_y) + c_3\sigma_3k_y + c_1\sigma_1k_x; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2k_x) + c_3\sigma_3k_x + c_1\sigma_2k_y; \\
A; \{R_1, R_1\}, \{R_2, R_2\}; & \quad \Gamma_{0,0} (c_1 + c_2k_x) + c_3\Gamma_{3,0}k_x + c_4\Gamma_{2,0}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{1,i}k_y + c_{i,2}\Gamma_{0,i}k_z + c_{i,3}\Gamma_{3,i}k_z); \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \quad \{R_1\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \quad \{R_1\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_2\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \quad \{R_3\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
G; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \quad \{R_1\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \quad \{R_1\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_2\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \quad \{R_3\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z;
\end{aligned}$$

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 $\Gamma_o; \{C_{2z}|\frac{1}{2}\frac{1}{2}0\}, \{\sigma_y|0\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
U; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
T; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
S; \{R_2, R_4\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z; \\
R; \{R_2, R_4\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z; \\
D; \{R_1, R_2\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z; \\
P; \{R_1, R_2\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z; \\
C; \{R_1, R_2\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
E; \{R_1, R_2\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
H; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_x + c_4\sigma_1k_y; \\
G; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_x + c_4\sigma_1k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_1\sigma_1k_x; \\
B; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_1\sigma_1k_x; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_1\sigma_2k_y; \\
A; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_1\sigma_2k_y; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
Q; \{R_5\}, \{R_6\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x;
\end{aligned}$$

$\Gamma_o; \{C_{2z}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_y|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$

$$\begin{aligned}
Y; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_x; \\
Z; \{R_2, R_4\}; & \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
& \quad \{R_6, R_8\}; \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
U; R_5; & \quad (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_y)k_z; \\
T; \{R_5, R_5\}; & \quad c_1\Gamma_{0,0} + c_2\Gamma_{0,1}k_x + c_3\Gamma_{0,3}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,0}k_z; \\
S; \{R_2, R_4\}; & \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
& \quad \{R_6, R_8\}; \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
R; \{R_2, R_4\}; & \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
& \quad \{R_6, R_8\}; \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
D; \{R_1, R_2\}; & \quad (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z; \\
P; \{R_1, R_2\}; & \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_3k_z; \\
B; \{R_1, R_1\}; & \quad (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^3 c_{i,1}\sigma_i k_z; \\
& \quad \{R_2, R_2\}; \quad (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^3 c_{i,1}\sigma_i k_z; \\
C; \{R_1, R_2\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
E; \{R_1, R_1\}; & \quad (c_1 + c_2k_x)\sigma_0 + \sum_{i=1}^3 c_{i,1}\sigma_i k_z; \\
& \quad \{R_2, R_2\}; \quad (c_1 + c_2k_x)\sigma_0 + \sum_{i=1}^3 c_{i,1}\sigma_i k_z; \\
A; \{R_1, R_2\}; & \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_z; \\
H; R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_x + c_4\sigma_1k_y; \\
G; R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_x + c_4\sigma_1k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2k_y) + c_3\sigma_3k_y + c_1\sigma_1k_x; \\
B; \{R_1, R_1\}, \{R_2, R_2\}; & \quad \Gamma_{0,0} (c_1 + c_2k_y) + c_3\Gamma_{3,0}k_y + c_4\Gamma_{1,0}k_x + \sum_{i=1}^3 (c_{i,1}\Gamma_{2,i}k_x + c_{i,2}\Gamma_{0,i}k_z + c_{i,3}\Gamma_{3,i}k_z); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2k_x) + c_3\sigma_3k_x + c_1\sigma_2k_y; \\
E; \{R_1, R_1\}, \{R_2, R_2\}; & \quad \Gamma_{0,0} (c_1 + c_2k_x) + c_3\Gamma_{3,0}k_x + c_4\Gamma_{2,0}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{1,i}k_y + c_{i,2}\Gamma_{0,i}k_z + c_{i,3}\Gamma_{3,i}k_z); \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \quad \{R_1\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \quad \{R_1\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_2\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \quad \{R_3\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
Q; \{R_5\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \quad \{R_5\}, \{R_7\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \quad \{R_5\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_6\}, \{R_7\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_6\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \quad \{R_7\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x;
\end{aligned}$$

SG 34

 $\Gamma_o; \{C_{2z}|\frac{1}{2}\frac{1}{2}0\}, \{\sigma_y|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
Z; \{R_2, R_4\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z; \\
U; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
T; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
S; \{R_2, R_4\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z; \\
D; \{R_1, R_2\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z; \\
B; \{R_1, R_2\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z; \\
C; \{R_1, R_2\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
A; \{R_1, R_2\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
H; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_x + c_4\sigma_1k_y; \\
G; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_x + c_4\sigma_1k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_1\sigma_1k_x; \\
P; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_1\sigma_1k_x; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_1\sigma_2k_y; \\
E; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_1\sigma_2k_y; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
Q; \{R_5\}, \{R_6\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x;
\end{aligned}$$

SG 35

 $\Gamma_o^b; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
& \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
\Lambda; & \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
H; & \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
D; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
A; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
\Delta; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
B; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
G; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
F; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
E; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
C; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y;
\end{aligned}$$

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SG 36

 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Z; & \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_6, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
T; & \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_6, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
R; & \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
A; & \{R_1, R_1\}; (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
& \{R_2, R_2\}; (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
B; & \{R_1, R_2\}; (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_3 k_z; \\
G; & \{R_1, R_2\}; (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_3 k_z; \\
E; & \{R_1, R_1\}; (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
& \{R_2, R_2\}; (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$H; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$D; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y);$
$A; \{R_1, R_1\}, \{R_2, R_2\};$	$\Gamma_{0,0} (c_1 + c_2 k_x) + c_3 \Gamma_{3,0} k_x + c_4 \Gamma_{2,0} k_y + \sum_{i=1}^3 (c_{i,1} \Gamma_{1,i} k_y + c_{i,2} \Gamma_{0,i} k_z + c_{i,3} \Gamma_{3,i} k_z);$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y;$
$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x;$
$F; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x;$
$E; \{R_1, R_1\}, \{R_2, R_2\};$	$\Gamma_{0,0} (c_1 + c_2 k_x) + c_3 \Gamma_{3,0} k_x + c_4 \Gamma_{2,0} k_y + \sum_{i=1}^3 (c_{i,1} \Gamma_{1,i} k_y + c_{i,2} \Gamma_{0,i} k_z + c_{i,3} \Gamma_{3,i} k_z);$
$C; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y;$

SG 37

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 $\Gamma_o^b; \{C_{2z}|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$Z; \{R_2, R_4\};$	$c_1 \sigma_0 + c_2 \sigma_3 k_z;$
$\{R_6, R_8\};$	$c_1 \sigma_0 + c_2 \sigma_3 k_z;$
$T; \{R_2, R_4\};$	$c_1 \sigma_0 + c_2 \sigma_3 k_z;$
$\{R_6, R_8\};$	$c_1 \sigma_0 + c_2 \sigma_3 k_z;$
$A; \{R_1, R_2\};$	$(c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y + c_5 \sigma_3 k_z;$
$B; \{R_1, R_2\};$	$(c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_x + c_5 \sigma_3 k_z;$
$G; \{R_1, R_2\};$	$(c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_x + c_5 \sigma_3 k_z;$
$E; \{R_1, R_2\};$	$(c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y + c_5 \sigma_3 k_z;$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
H; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
D; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
F; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
C; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y;
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_2 k_x; \\
H; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_2 k_x; \\
A; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
B; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
G; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
F; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
E; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
C; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;
\end{aligned}$$

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SG 39

 $\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
S; \{R_2, R_4\}; & c_1 \sigma_0 + (c_2 k_x + c_3 k_y) \sigma_3; \\
R; \{R_2, R_4\}; & c_1 \sigma_0 + (c_2 k_x + c_3 k_y) \sigma_3; \\
D; \{R_1, R_1\}; & (c_1 + c_2 k_z) \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_y) \sigma_i
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_2 k_x; \\
H; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_2 k_x; \\
A; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
B; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
G; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
F; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
E; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
C; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;
\end{aligned}$$

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SG 40

 $\Gamma_{o;}^b; \{C_{2y}|000\}, \{\sigma_x|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Z; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
T; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
A; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_3 k_y + (c_4 \sigma_1 + c_5 \sigma_2) k_z; \\
B; R_5; & (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_2 k_x + c_4 \sigma_1 k_z; \\
G; R_5; & (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_2 k_x + c_4 \sigma_1 k_z; \\
E; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_3 k_y + (c_4 \sigma_1 + c_5 \sigma_2) k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_2 k_x; \\
&H; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_2 k_x; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&F; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&C; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;
\end{aligned}$$

SG 41

 $\Gamma_{o;}^b; \{C_{2y}|000\}, \{\sigma_x|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Z; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
T; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
S; \{R_2, R_4\}; & \quad c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_3; \\
R; \{R_2, R_4\}; & \quad c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_3; \\
D; \{R_1, R_1\}; & \quad (c_1 + c_2k_z)\sigma_0 + \sum_{i=1}^3 (c_{i,1}k_x + c_{i,2}k_y)\sigma_i; \\
A; \{R_2, R_4\}; & \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
B; R_5; & \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z; \\
G; R_5; & \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z; \\
E; \{R_2, R_4\}; & \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_2k_x; \\
H; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_2k_x; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_z; \\
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y; \\
& \quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_z; \\
& \quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_x; \\
& \quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_x; \\
& \quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_z; \\
& \quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y; \\
F; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y; \\
& \quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_z; \\
& \quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_x; \\
& \quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_x; \\
& \quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_z; \\
& \quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y; \\
C; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_z;
\end{aligned}$$

SG 42

 $\Gamma_{o;}^f; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$

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Accidental degeneracies on high symmetry line

- $\Lambda$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;  
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x$ ;  
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y$ ;  
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y$ ;  
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x$ ;  
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;  
 $G$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;  
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x$ ;  
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y$ ;  
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y$ ;  
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x$ ;  
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;  
 $H$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;  
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x$ ;  
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y$ ;  
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y$ ;  
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x$ ;  
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;  
 $Q$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;  
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x$ ;  
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y$ ;  
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y$ ;  
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x$ ;  
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;  
 $\Sigma$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y$ ;  
 $C$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y$ ;  
 $A$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y$ ;  
 $U$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y$ ;  
 $\Delta$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x$ ;  
 $D$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x$ ;  
 $B$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x$ ;  
 $R$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x$ ;

SG 43

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 $\Gamma_o^f; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|\frac{1}{2}00\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Y; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_x; \\
Z; \{R_2, R_4\}; & \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
& \quad \{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z; \\
G; R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_x + c_4\sigma_1k_y; \\
H; R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_x + c_4\sigma_1k_y; \\
C; \{R_1, R_2\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
A; \{R_1, R_2\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
D; \{R_1, R_2\}; & \quad (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z; \\
B; \{R_1, R_2\}; & \quad (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
Q; \{R_5\}, \{R_6\}; & \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_1\sigma_2k_y; \\
U; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_1\sigma_2k_y; \\
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_1\sigma_1k_x; \\
R; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_1\sigma_1k_x;
\end{aligned}$$

SG 44

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 $\Gamma_o^v; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
G; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
P; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
F; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
\Delta; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
U; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x;
\end{aligned}$$

SG 45

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 $\Gamma_{\text{o}}^v; \{C_{2z}|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
R; & \{R_2, R_4\}; c_1 \sigma_0 + (c_2 k_x + c_3 k_z) \sigma_3; \\
S; & \{R_2, R_4\}; c_1 \sigma_0 + (c_2 k_y + c_3 k_z) \sigma_3; \\
W; & \{R_1, R_1\}; c_1 \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
& \{R_2, R_2\}; c_1 \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
D; & \{R_1, R_1\}; (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_y + c_{i,2} k_z) \sigma_i; \\
Q; & \{R_1, R_1\}; (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z) \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
G; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
P; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
F; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
\Delta; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
U; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x;
\end{aligned}$$

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SG 46

 $\Gamma_o^v; \{C_{2z}|000\}, \{\sigma_y|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
S; & \{R_2, R_4\}; c_1 \sigma_0 + (c_2 k_y + c_3 k_z) \sigma_3; \\
W; & \{R_1, R_2\}; c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_y + c_2 \sigma_3 k_z; \\
D; & \{R_1, R_1\}; (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_y + c_{i,2} k_z) \sigma_i;
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
G; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
P; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
F; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_1 \sigma_2 k_y; \\
\Delta; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x; \\
U; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_1 \sigma_1 k_x;
\end{aligned}$$



[illegible]

SG 48

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

 $Y; R_5; c_1\sigma_0 + c_2\sigma_2k_y;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_y;$ 
 $X; R_5; c_1\sigma_0 + c_2\sigma_2k_x;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_x;$ 
 $Z; R_5; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $U; R_5; c_1\sigma_0 + c_2\sigma_2k_y;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_y;$ 
 $T; R_5; c_1\sigma_0 + c_2\sigma_2k_x;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_x;$ 
 $S; R_5; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $D; R_5; (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x + c_4\sigma_2k_z;$ 
 $B; R_5; (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z;$ 
 $C; R_5; (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y + c_4\sigma_2k_z;$ 
 $A; R_5; (c_1 + c_2k_x)\sigma_0 + c_3\sigma_2k_y + c_4\sigma_1k_z;$ 
 $H; R_5; (c_1 + c_2k_z)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_y;$ 
 $G; R_5; (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1k_x + c_4\sigma_2k_y;$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&P; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Sigma; \{R_1\}, \{R_2\}; (c_1 + c_2 k_x) + \sigma_3(c_3 + c_4 k_x); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; (c_1 + c_2 k_x) + \sigma_3(c_3 + c_4 k_x); \\
&E; \{R_2\}, \{R_4\}; (c_1 + c_2 k_x) + \sigma_3(c_3 + c_4 k_x); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_6\}, \{R_8\}; (c_1 + c_2 k_x) + \sigma_3(c_3 + c_4 k_x); \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&Q; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

SG 49

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC
 $Z; R_5; \quad c_1\sigma_0 + c_2\sigma_2k_z;$  $R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_z;$  $U; R_5; \quad c_1\sigma_0 + c_2\sigma_2k_z;$  $R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_z;$  $T; R_5; \quad c_1\sigma_0 + c_2\sigma_2k_z;$  $R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_z;$  $R; R_5; \quad c_1\sigma_0 + c_2\sigma_2k_z;$  $R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_z;$  $P; R_5; \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z;$  $B; R_5; \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z;$  $E; R_5; \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_2k_y + c_4\sigma_1k_z;$  $A; R_5; \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_2k_y + c_4\sigma_1k_z;$



SG 50

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

 $Y; R_5; c_1\sigma_0 + c_2\sigma_2k_y;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_y;$ 
 $X; R_5; c_1\sigma_0 + c_2\sigma_2k_x;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_x;$ 
 $U; R_5; c_1\sigma_0 + c_2\sigma_2k_x;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_x;$ 
 $T; R_5; c_1\sigma_0 + c_2\sigma_2k_y;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_y;$ 
 $S; R_5; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $R; R_5; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $R_{10}; c_1\sigma_0 + c_2\sigma_2k_z;$ 
 $D; R_5; (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x + c_4\sigma_2k_z;$ 
 $P; R_5; (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x + c_4\sigma_2k_z;$ 
 $C; R_5; (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y + c_4\sigma_2k_z;$ 
 $E; R_5; (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y + c_4\sigma_2k_z;$ 
 $H; R_5; (c_1 + c_2k_z)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_y;$ 
 $G; R_5; (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1k_x + c_4\sigma_2k_y;$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&B; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&A; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&Q; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

SG 51

 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Z; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
U; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
T; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
P; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_z; \\
B; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_z; \\
E; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
\{R_6, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
A; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
\{R_6, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$D; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$C; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$E; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$A; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$H; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$Q; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$

$$\begin{aligned}
G; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

SG 52

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 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
X; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_x; \\
R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_x; \\
Z; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
U; \{R_9, R_{10}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_x + c_3 \Gamma_{3,1} k_y + \sum_{i=1}^2 c_{i,1} \Gamma_{i,2} k_z; \\
T; R_5; & (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2 \sigma_3 k_x + c_3 \sigma_1 k_y) k_z; \\
R_{10}; & (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2 \sigma_3 k_x + c_3 \sigma_1 k_y) k_z; \\
S; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
D; R_5; & (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_1 k_x + c_4 \sigma_2 k_z; \\
P; \{R_2, R_8\}; & (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
\{R_4, R_6\}; & (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
B; R_5; & (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_1 k_z; \\
C; R_5; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 k_z; \\
E; R_5; & (c_2 k_x + c_1) \sigma_0 + c_3 \sigma_2 k_z; \\
A; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
\{R_6, R_8\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
H; R_5; & (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_2 k_x + c_4 \sigma_1 k_y; \\
G; R_5; & (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_1 k_x + c_4 \sigma_2 k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$P; \{R_2, R_8\}, \{R_4, R_6\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_y + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$A; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$Q; \{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_2\}, \{R_6\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_8\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_4\}, \{R_6\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_4\}, \{R_8\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_6\}, \{R_8\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$

SG 53

 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
Z; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
U; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
T; R_5; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_y)k_z; \\
R_{10}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_y)k_z; \\
S; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R; R_5; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_y)k_z; \\
R_{10}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_y)k_z; \\
P; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_z; \\
B; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_z; \\
C; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y + c_4\sigma_2k_z; \\
E; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_2k_z; \\
A; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 - c_4\sigma_2)k_z; \\
& \{R_6, R_8\}; (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 - c_4\sigma_2)k_z; \\
H; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_y; \\
Q; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$D; \{R_1\}, \{R_2\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$A; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$G; \{R_1\}, \{R_2\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$

SG 54

 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|0\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
Z; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
U; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + c_3\Gamma_{3,1}k_y + \sum_{i=1}^2 c_{i,1}\Gamma_{i,2}k_z; \\
T; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
S; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + c_3\Gamma_{3,1}k_y + \sum_{i=1}^2 c_{i,1}\Gamma_{i,2}k_z; \\
D; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x + c_4\sigma_2k_z; \\
P; \{R_2, R_6\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
\{R_4, R_8\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
B; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_z; \\
E; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
\{R_6, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
A; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
\{R_6, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
Q; R_5; & (c_1 + c_3k_z)\sigma_0 + c_2\sigma_1k_x + c_4\sigma_2k_y; \\
G; R_5; & (c_1 + c_3k_z)\sigma_0 + c_2\sigma_1k_x + c_4\sigma_2k_y;
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$P; \{R_2, R_6\}, \{R_4, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_y + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$C; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$E; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$A; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$H; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
U; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
T; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
S; \{R_2, R_4\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
\{R_6, R_8\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
\{R_{10}, R_{12}\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
\{R_{14}, R_{16}\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
R; \{R_2, R_4\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
\{R_6, R_8\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
\{R_{10}, R_{12}\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
\{R_{14}, R_{16}\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
D; \{R_2, R_4\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
\{R_6, R_8\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
P; \{R_2, R_4\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
\{R_6, R_8\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
C; \{R_2, R_4\}; & (c_2k_x + c_1)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_6, R_8\}; & (c_2k_x + c_1)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
E; \{R_2, R_4\}; & (c_2k_x + c_1)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_6, R_8\}; & (c_2k_x + c_1)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
H; R_5; & (c_2k_z + c_1)\sigma_0 + c_3\sigma_1k_y; \\
Q; \{R_2, R_4\}; & (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_xk_y; \\
\{R_6, R_8\}; & (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_xk_y; \\
G; R_5; & (c_2k_z + c_1)\sigma_0 + c_3\sigma_1k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$D; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_y + k_x (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$P; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_y + k_x (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$B; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$C; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$E; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$A; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$Q; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} c_{i,1} \Gamma_{i,0} k_z + k_x (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}) + k_y (c_4 \Gamma_{1,1} + c_5 \Gamma_{1,2});$

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
Z; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
U; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + \sum_{i=1}^2 c_{i,1}\Gamma_{i,2}k_x + c_2\Gamma_{0,2}k_y + c_3\Gamma_{3,1}k_z; \\
T; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + \sum_{i=1}^2 c_{i,1}\Gamma_{i,2}k_y + c_3\Gamma_{3,1}k_z; \\
S; R_5; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + c_2\sigma_3k_xk_y; \\
R_{10}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + c_2\sigma_3k_xk_y; \\
R; \{R_2, R_4\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y \\
\{R_6, R_8\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y \\
\{R_{10}, R_{12}\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y \\
\{R_{14}, R_{16}\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y \\
D; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x; \\
P; \{R_2, R_8\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
\{R_4, R_6\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
B; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z; \\
C; R_5; & (c_1 + c_2k_x)\sigma_0 + c_2\sigma_3k_y; \\
E; \{R_2, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_4, R_6\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
A; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_2k_y + c_4\sigma_1k_z; \\
H; \{R_1, R_4\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_2, R_3\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
Q; \{R_1, R_2\}; & (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
\{R_3, R_4\}; & (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
G; \{R_1, R_3\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
\{R_2, R_4\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
P; \{R_2, R_8\}, \{R_4, R_6\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [\Gamma_{i,0} c_{i,1} k_y + k_x (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
E; \{R_2, R_8\}, \{R_4, R_6\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [\Gamma_{i,0} c_{i,1} k_x + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}); \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
H; \{R_1, R_4\}, \{R_2, R_3\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_z + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}); \\
Q; \{R_1, R_2\}, \{R_3, R_4\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} c_{i,1} \Gamma_{i,0} k_z + k_x (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}) + k_y (c_4 \Gamma_{1,1} + c_5 \Gamma_{1,2}); \\
G; \{R_1, R_3\}, \{R_2, R_4\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_z + k_x (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});
\end{aligned}$$

SG 57

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|0\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
U; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
T; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
S; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + (c_3\Gamma_{1,2} + c_4\Gamma_{2,2})k_y; \\
R; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + (c_3\Gamma_{1,2} + c_4\Gamma_{2,2})k_y; \\
D; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x; \\
P; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x; \\
C; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_2 + c_4\sigma_1)k_y; \\
& \{R_6, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_2 + c_4\sigma_1)k_y; \\
E; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_2 + c_4\sigma_1)k_y; \\
& \{R_6, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_2 + c_4\sigma_1)k_y; \\
H; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1k_y; \\
Q; \{R_5, R_5\}; & (c_1 + c_5k_z)\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_y); \\
G; \{R_1, R_3\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
& \{R_2, R_4\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$B; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$C; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$E; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$A; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$G; \{R_1, R_3\}, \{R_2, R_4\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_z + k_x (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
Z; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
U; R_5; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_3k_y + c_3\sigma_1k_z)k_x; \\
R_{10}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_3k_y + c_3\sigma_1k_z)k_x; \\
T; R_5; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_z)k_y; \\
R_{10}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_z)k_y; \\
S; \{R_2, R_4\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
\{R_6, R_8\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
\{R_{10}, R_{12}\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
\{R_{14}, R_{16}\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_y; \\
R; R_5; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + c_3\sigma_3k_xk_y \\
R_{10}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + c_3\sigma_3k_xk_y \\
D; \{R_2, R_4\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
\{R_6, R_8\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
P; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x; \\
B; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z; \\
C; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_6, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
E; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y; \\
A; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_2k_y + c_4\sigma_1k_z; \\
H; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1k_y; \\
Q; \{R_2, R_4\}; & (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_xk_y; \\
\{R_6, R_8\}; & (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_xk_y; \\
G; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1k_x;
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
D; \{R_2, R_4\}, \{R_6, R_8\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_y + k_x (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
C; \{R_2, R_4\}, \{R_6, R_8\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}); \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
Q; \{R_2, R_4\}, \{R_6, R_8\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} c_{i,1} \Gamma_{i,0} k_z + k_x (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}) + k_y (c_4 \Gamma_{1,1} + c_5 \Gamma_{1,2});
\end{aligned}$$

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
U; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
T; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
S; R_5; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + c_3\sigma_3k_xk_y; \\
R_{10}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + c_3\sigma_3k_xk_y; \\
R; R_5; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + c_3\sigma_3k_xk_y; \\
R_{10}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + c_3\sigma_3k_xk_y; \\
D; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x; \\
P; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x; \\
C; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_y; \\
E; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_y; \\
H; \{R_1, R_4\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
& \{R_2, R_3\}; (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
Q; \{R_1, R_2\}; & (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_xk_y \\
& \{R_3, R_4\}; (c_1 + c_2k_z + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_xk_y \\
G; \{R_1, R_3\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
& \{R_2, R_4\}; (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$B; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$A; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$H; \{R_1, R_4\}, \{R_2, R_3\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_z + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$Q; \{R_1, R_2\}, \{R_3, R_4\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} c_{i,1} \Gamma_{i,0} k_z + k_x (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}) + k_y (c_4 \Gamma_{1,1} + c_5 \Gamma_{1,2});$
$G; \{R_1, R_3\}, \{R_2, R_4\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_z + k_x (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$

SG 60

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}0\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
Z; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
U; R_5; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_3k_y + c_3\sigma_1k_z)k_x; \\
R_{10}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_3k_y + c_3\sigma_1k_z)k_x; \\
T; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + \sum_{i=1}^2 c_{i,1}\Gamma_{i,2}k_y + c_3\Gamma_{3,1}k_z; \\
S; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + \sum_{i=1}^2 c_{i,1}\Gamma_{i,2}k_x + c_2\Gamma_{0,2}k_y; \\
R; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + \sum_{i=1}^2 c_{i,1}\Gamma_{i,2}k_y; \\
D; \{R_2, R_4\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
\{R_6, R_8\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
P; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_3k_x; \\
B; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z; \\
C; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_y; \\
E; \{R_2, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_4, R_6\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
A; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_2k_y + c_4\sigma_1k_z; \\
H; \{R_1, R_4\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_2, R_3\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
Q; \{R_5, R_5\}; & (c_1 + c_5k_z)\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,2}k_y); \\
G; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
D; \{R_2, R_4\}, \{R_6, R_8\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_y + k_x (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
C; \{R_5\}, \{R_5\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} c_{i,1} \Gamma_{i,0} k_x + \Gamma_{1,0} (c_2 + c_3 k_x) + (c_4 \Gamma_{0,3} + c_5 \Gamma_{1,3} + c_6 \Gamma_{3,3}) k_y + c_7 \Gamma_{2,1} k_z; \\
E; \{R_2, R_8\}, \{R_4, R_6\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [\Gamma_{i,0} c_{i,1} k_x + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}); \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
H; \{R_1, R_4\}, \{R_2, R_3\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_z + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});
\end{aligned}$$

SG 61

 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
Z; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
U; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + (c_3\Gamma_{1,2} + c_4\Gamma_{2,2})k_z; \\
T; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + (c_2\Gamma_{1,2} + c_3\Gamma_{2,2})k_y + c_4\Gamma_{0,2}k_z; \\
S; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + (c_2\Gamma_{1,2} + c_3\Gamma_{2,2})k_x + c_4\Gamma_{0,2}k_y; \\
R; \{R_5, R_5\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\Gamma_{0,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_xk_y + \sum_{i=1}^3 (c_{i,2}\Gamma_{i,1}k_xk_z + c_{i,3}\Gamma_{i,2}k_yk_z); \\
\{R_{10}, R_{10}\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\Gamma_{0,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_xk_y + \sum_{i=1}^3 (c_{i,2}\Gamma_{i,1}k_xk_z + c_{i,3}\Gamma_{i,2}k_yk_z); \\
D; \{R_2, R_4\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
\{R_6, R_8\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
P; \{R_5, R_5\}; & (c_1 + c_2k_y)\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,3}k_x + c_{i,2}\Gamma_{i,1}k_z); \\
B; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_z; \\
C; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y; \\
E; \{R_5, R_5\}; & (c_1 + c_2k_x)\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_y + c_{i,2}\Gamma_{i,3}k_z); \\
A; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
\{R_6, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
H; \{R_2, R_4\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_6, R_8\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
Q; \{R_5, R_5\}; & (c_1 + c_2k_z)\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,3}k_y); \\
G; R_5; & (c_1 + c_2k_z)\sigma_0 + c_2\sigma_1k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
D; \{R_2, R_4\}, \{R_6, R_8\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_y + k_x (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
A; \{R_2, R_4\}, \{R_6, R_8\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}); \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
H; \{R_2, R_4\}, \{R_6, R_8\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_z + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});
\end{aligned}$$

$\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Y; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_x; \\
Z; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
U; \{R_2, R_4\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_z \\
\{R_6, R_8\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_z \\
\{R_{10}, R_{12}\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_z \\
\{R_{14}, R_{16}\}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_xk_z \\
T; R_5; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + c_2\sigma_3k_yk_z \\
R_{10}; & (c_1 + \sum_{i=x}^z c_i k_i^2)\sigma_0 + c_2\sigma_3k_yk_z \\
S; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + c_3\Gamma_{3,1}k_x + (c_4\Gamma_{1,2} + c_2\Gamma_{2,2})k_y; \\
R; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + c_3\Gamma_{0,2}k_y; \\
D; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x; \\
P; \{R_2, R_6\}; & (c_1 + c_2k_y + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_xk_z; \\
\{R_4, R_8\}; & (c_1 + c_2k_y + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_xk_z; \\
B; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_z; \\
C; \{R_1, R_3\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
E; \{R_2, R_6\}; & (c_1 + c_2k_x + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_yk_z; \\
\{R_4, R_8\}; & (c_1 + c_2k_x + \sum_{i=x}^z c_i k_i^2)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_yk_z; \\
A; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
\{R_6, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
H; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1k_y; \\
Q; \{R_5, R_5\}; & (c_1 + c_2k_z)\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,3}k_x + c_{i,2}\Gamma_{i,1}k_y); \\
G; \{R_1, R_3\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x; \\
\{R_2, R_4\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x;
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
P; \{R_2, R_6\}, \{R_4, R_8\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} c_{i,1} \Gamma_{i,0} k_y + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) + k_z (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
C; \{R_1, R_3\}, \{R_2, R_4\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_y (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}); \\
E; \{R_2, R_6\}, \{R_4, R_8\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_x + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) + k_z (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}); \\
A; \{R_2, R_4\}, \{R_6, R_8\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_x + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}); \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
G; \{R_1, R_3\}, \{R_2, R_4\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_z + k_x (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_y (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});
\end{aligned}$$

SG 63

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 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
Z; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{10}; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
T; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{10}; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
A; R_5; & \quad (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_1 k_z; \\
B; \{R_2, R_4\}; & \quad (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
\{R_6, R_8\}; & \quad (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
G; \{R_2, R_4\}; & \quad (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
\{R_6, R_8\}; & \quad (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
E; R_5; & \quad (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_1 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$H; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$D; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sigma_1 (c_4 k_x + c_5 k_y);$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$B; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_y + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$G; \{R_2, R_4\}, \{R_6, R_8\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_y + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2});$
$F; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;$
$C; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;$

SG 64

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 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Z; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
T; R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{10}; & \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
S; R_5; & \quad c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2; \\
R; \{R_2, R_4\}; & \quad (c_1 + c_2k_xk_y + \sum_{i=x}^z c_ik_i^2)\sigma_0 + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y)k_z; \\
\{R_6, R_8\}; & \quad (c_1 + c_2k_xk_y + \sum_{i=x}^z c_ik_i^2)\sigma_0 + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y)k_z; \\
D; \{R_1, R_2\}; & \quad (c_1 + c_4k_z)\sigma_0 + \sum_{i=1}^2 (c_{i,1}k_x + c_{i,2}k_y)\sigma_i; \\
A; R_5; & \quad (c_1 + c_4k_x)\sigma_0 + c_3\sigma_1k_z; \\
B; \{R_2, R_4\}; & \quad (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
\{R_6, R_8\}; & \quad (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
G; \{R_2, R_4\}; & \quad (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
\{R_6, R_8\}; & \quad (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
E; R_5; & \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$\Lambda$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$\{R_1\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x$ ;
$\{R_1\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y$ ;
$\{R_2\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y$ ;
$\{R_2\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x$ ;
$\{R_3\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$H$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$\{R_1\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x$ ;
$\{R_1\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y$ ;
$\{R_2\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y$ ;
$\{R_2\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x$ ;
$\{R_3\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$\Sigma$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x$ ;
$\{R_1\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y$ ;
$\{R_1\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z$ ;
$\{R_2\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z$ ;
$\{R_2\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y$ ;
$\{R_3\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x$ ;
$\Delta$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y$ ;
$\{R_1\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z$ ;
$\{R_1\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x$ ;
$\{R_2\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x$ ;
$\{R_2\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z$ ;
$\{R_3\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y$ ;
$B$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_y + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2})$ ;
$G$ ; $\{R_2, R_4\}, \{R_6, R_8\}$ ;	$c_1 \Gamma_{0,0} + \sum_{i=0,3} [c_{i,1} \Gamma_{i,0} k_y + k_z (c_{i,2} \Gamma_{i,1} + c_{i,3} \Gamma_{i,2})] + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2})$ ;
$F$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y$ ;
$\{R_1\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z$ ;
$\{R_1\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x$ ;
$\{R_2\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x$ ;
$\{R_2\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z$ ;
$\{R_3\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y$ ;
$C$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x$ ;
$\{R_1\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y$ ;
$\{R_1\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z$ ;
$\{R_2\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z$ ;
$\{R_2\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y$ ;
$\{R_3\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x$ ;

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Accidental degeneracies on high symmetry line

- $\Lambda$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z;$   
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_x;$   
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_y;$   
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_y;$   
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_x;$   
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z;$
- $H$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z;$   
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_x;$   
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_y;$   
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_y;$   
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_x;$   
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z;$
- $D$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y);$
- $A$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x;$   
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_1k_y;$   
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_z;$   
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_z;$   
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_1k_y;$   
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x;$
- $\Sigma$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x;$   
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_1k_y;$   
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_z;$   
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_z;$   
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_1k_y;$   
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x;$
- $\Delta$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y;$   
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z;$   
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x;$   
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x;$   
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z;$   
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y;$
- $B$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y;$   
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z;$   
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x;$   
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x;$   
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z;$   
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y;$
- $G$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y;$   
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z;$   
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x;$   
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x;$   
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z;$   
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y;$

$$\begin{aligned}
&F; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&E; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&C; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

SG 66

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 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
&Z; R_5; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
&\quad R_{10}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
&T; R_5; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
&\quad R_{10}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
&A; R_5; \quad (c_1 + c_2 k_x) \sigma_0 + c_4 \sigma_2 k_y + c_3 \sigma_1 k_z; \\
&B; R_5; \quad (c_1 + c_2 k_y) \sigma_0 + c_4 \sigma_2 k_x + c_3 \sigma_1 k_z; \\
&G; R_5; \quad (c_1 + c_2 k_y) \sigma_0 + c_4 \sigma_2 k_x + c_3 \sigma_1 k_z; \\
&E; R_5; \quad c_1 \sigma_0 + (c_2 k_x + c_3 k_y) \sigma_2 + c_4 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
H; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
D; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sigma_1(c_4 k_x + c_5 k_y); \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\Delta; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
F; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
C; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

SG 67

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 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$S; R_5; \quad c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2;$$

$$R; R_5; \quad c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2;$$

$$D; \{R_1, R_2\}; (c_1 + c_2k_z)\sigma_0 + \sum_{i=1}^2 (c_{i,1}k_x + c_{i,2}k_y)\sigma_i;$$





$$\begin{aligned}
&E; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&C; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

SG 68

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 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
Z; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{10}; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
T; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{10}; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
S; R_5; & \quad c_1 \sigma_0 + (c_2 k_x + c_3 k_y) \sigma_2; \\
R; R_5; & \quad c_1 \sigma_0 + (c_2 k_x + c_3 k_y) \sigma_2; \\
D; \{R_1, R_2\}; & \quad (c_1 + c_2 k_z) \sigma_0 + \sum_{i=1}^2 (c_{i,1} k_x + c_{i,2} k_y) \sigma_i; \\
A; R_5; & \quad (c_1 + c_2 k_x) \sigma_0 + c_4 \sigma_2 k_y + c_3 \sigma_1 k_z; \\
B; R_5; & \quad (c_1 + c_2 k_y) \sigma_0 + c_4 \sigma_2 k_x + c_3 \sigma_1 k_z; \\
G; R_5; & \quad (c_1 + c_2 k_y) \sigma_0 + c_4 \sigma_2 k_x + c_3 \sigma_1 k_z; \\
E; R_5; & \quad (c_1 + c_2 k_x) \sigma_0 + c_4 \sigma_2 k_y + c_3 \sigma_1 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
H; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\Delta; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
F; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
C; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$



$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y; \\
&D; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y; \\
&B; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y; \\
&R; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y;
\end{aligned}$$

SG 70

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 $\Gamma_o^f; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
&Y; R_5; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
&\quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
&X; R_5; \quad c_1\sigma_0 + c_2\sigma_2k_x; \\
&\quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_x; \\
&Z; R_5; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
&\quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
&G; R_5; \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1k_x + c_4\sigma_2k_y; \\
&H; R_5; \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_y; \\
&C; R_5; \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y + c_4\sigma_2k_z; \\
&A; R_5; \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_2k_y + c_4\sigma_1k_z; \\
&D; R_5; \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_1k_x + c_4\sigma_2k_z; \\
&B; R_5; \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
Q; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
U; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\Delta; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
R; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y;
\end{aligned}$$

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SG 71

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$\Gamma_o^v$ ;  $\{C_{2z}|000\}$ ,  $\{C_{2y}|000\}$ ,  $\{I|000\}$ ,  $\mathcal{T}$ ; Centrosymmetric; without SOC

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Accidental degeneracies on high symmetry line

- $\Lambda$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z$ ;  
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_x$ ;  
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_y$ ;  
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_y$ ;  
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_x$ ;  
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z$ ;  
 $G$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z$ ;  
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_x$ ;  
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_y$ ;  
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_y$ ;  
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_x$ ;  
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z$ ;  
 $P$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_4k_x + c_5k_y)$ ;  
 $\Sigma$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x$ ;  
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_1k_y$ ;  
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_z$ ;  
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_z$ ;  
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_1k_y$ ;  
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x$ ;  
 $F$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x$ ;  
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_1k_y$ ;  
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_z$ ;  
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_4\sigma_1k_z$ ;  
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_1k_y$ ;  
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x$ ;  
 $D$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + \sigma_1(c_5k_y + c_6k_z)$ ;  
 $\Delta$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y$ ;  
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z$ ;  
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x$ ;  
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x$ ;  
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z$ ;  
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y$ ;  
 $U$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y$ ;  
 $\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z$ ;  
 $\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x$ ;  
 $\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x$ ;  
 $\{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_z$ ;  
 $\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y$ ;  
 $Q$ ;  $\{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + \sigma_1(c_5k_x + c_6k_z)$ ;



SG 72

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 $\Gamma_o^v; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$R; \quad R_5; \quad c_1\sigma_0 + (c_2k_x + c_3k_z)\sigma_2;$$

$$S; \quad R_5; \quad c_1\sigma_0 + (c_2k_y + c_3k_z)\sigma_2;$$

$$W; \quad \{R_1, R_2\}; \quad c_1\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_z;$$

$$\quad \{R_3, R_4\}; \quad c_1\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_z;$$

$$D; \quad \{R_1, R_2\}; \quad (c_1 + c_2k_x)\sigma_0 + \sum_{i=1}^2 (c_{i,1}k_y + c_{i,2}k_z)\sigma_i;$$

$$Q; \quad \{R_1, R_2\}; \quad (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^2 (c_{i,1}k_x + c_{i,2}k_z)\sigma_i;$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&G; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&P; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sigma_1(c_4 k_x + c_5 k_y); \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&F; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&U; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y;
\end{aligned}$$

SG 73

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 $\Gamma_o^v; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$R; R_5; \quad c_1\sigma_0 + (c_2k_x + c_3k_z)\sigma_2;$$

$$S; R_5; \quad c_1\sigma_0 + (c_2k_y + c_3k_z)\sigma_2;$$

$$T; R_5; \quad c_1\sigma_0 + (c_2k_x + c_3k_y)\sigma_2;$$

$$W; \{R_9, R_9\}; 2c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,3}k_y + c_{i,3}\Gamma_{i,1}k_z);$$

$$P; \{R_2, R_4\}; (c_1 + c_2k_z)\sigma_0 + \sum_{i=1}^2 (c_{i,1}k_x + c_{i,2}k_y)\sigma_i;$$

$$D; \{R_2, R_4\}; (c_1 + c_2k_x)\sigma_0 + \sum_{i=1}^2 (c_{i,1}k_y + c_{i,2}k_z)\sigma_i;$$

$$Q; \{R_2, R_4\}; (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^2 (c_{i,1}k_x + c_{i,2}k_z)\sigma_i;$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&G; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&F; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&U; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y;
\end{aligned}$$

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SG 74

 $\Gamma_o^v; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
T; R_5; & \quad c_1 \sigma_0 + (c_2 k_x + c_3 k_y) \sigma_2; \\
W; R_9; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_x + c_3 \sigma_3 k_y; \\
P; \{R_2, R_4\}; & (c_1 + c_2 k_z) \sigma_0 + \sum_{i=1}^2 (c_{i,1} k_x + c_{i,2} k_y) \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&G; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&F; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&D; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + \sigma_1(c_5 k_y + c_6 k_z); \\
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&U; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&Q; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + \sigma_1(c_5 k_x + c_6 k_z);
\end{aligned}$$

SG 75

 $\Gamma_q; \{C_{4z}^+|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned} \Gamma; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\ M; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\ Z; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\ A; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\ & \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\ & \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\ & \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\ & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\ & \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\ V; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\ & \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\ & \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\ & \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\ & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\ & \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\ W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \end{aligned}$$

SG 76

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{4}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned} \Gamma; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\ M; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\ Z; \{R_2, R_8\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\ & \{R_4, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\ A; \{R_2, R_8\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\ & \{R_4, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\ R; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\ U; \{R_1, R_1\}; & (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\ S; \{R_1, R_1\}; & (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\ T; \{R_1, R_1\}; & (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
V; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y);
\end{aligned}$$

SG 77

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 $\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\
M; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\
Z; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\
A; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
V; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y);
\end{aligned}$$

SG 78

 $\Gamma_q; \{C_{4z}^+ | 00\frac{3}{4}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; \{R_2, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\
M; \{R_2, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\
Z; \{R_2, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
\{R_4, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
A; \{R_2, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
\{R_4, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
R; \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
U; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
S; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
T; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
V; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
W; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y);
\end{aligned}$$

SG 79

 $\Gamma_q^v; \{C_{4z}^+ | 000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; \{R_2, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\
Z; \{R_2, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\
P; \{R_2, R_2\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^3 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2) + c_{i,3} k_z] \sigma_i;
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
V; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y);
\end{aligned}$$

SG 80

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 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\
Z; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i + c_4 \sigma_3 k_z; \\
P; \{R_1, R_2\}; & c_1 \sigma_0 + c_3 (\sigma_2 k_x + \sigma_1 k_y) + c_4 (\sigma_1 k_x - \sigma_2 k_y) + c_2 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
V; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y);
\end{aligned}$$

SG 81

 $\Gamma_q; \{S_{4z}^+|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
M; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
Z; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
A; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
\Lambda; \{R_2, R_2\}; & (c_1 + c_2 k_z + c_3 k_z^2 + c_4 k_z^3) \sigma_0 + \sum_{i=1}^3 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
V; \{R_2, R_2\}; & (c_1 + c_2 k_z + c_3 k_z^2 + c_4 k_z^3) \sigma_0 + \sum_{i=1}^3 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2, R_2\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + (A_4 c_3 + A_6 c_4 - A_1 c_6 - A_2 c_7) k_x + (-A_6 c_3 + A_4 c_4 - A_2 c_6 + A_1 c_7) k_y; \\
V; \{R_1\}, \{R_2, R_2\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + (A_4 c_3 + A_6 c_4 - A_1 c_6 - A_2 c_7) k_x + (-A_6 c_3 + A_4 c_4 - A_2 c_6 + A_1 c_7) k_y; \\
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y);
\end{aligned}$$

SG 82

 $\Gamma_q^v; \{S_{4z}^+|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$$\begin{aligned}
& \{R_2, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
Z; \{R_2, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
\Lambda; \{R_2, R_2\}; & (c_1 + c_2 k_z + c_3 k_z^2 + c_4 k_z^3) \sigma_0 + \sum_{i=1}^3 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
V; \{R_2, R_2\}; & (c_1 + c_2 k_z + c_3 k_z^2 + c_4 k_z^3) \sigma_0 + \sum_{i=1}^3 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2, R_2\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + (A_4 c_3 + A_6 c_4 - A_1 c_6 - A_2 c_7) k_x + (-A_6 c_3 + A_4 c_4 - A_2 c_6 + A_1 c_7) k_y; \\
V; \{R_1\}, \{R_2, R_2\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + (A_4 c_3 + A_6 c_4 - A_1 c_6 - A_2 c_7) k_x + (-A_6 c_3 + A_4 c_4 - A_2 c_6 + A_1 c_7) k_y; \\
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y);
\end{aligned}$$

SG 83

 $\Gamma_q; \{C_{4z}^+|000\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_4\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
& \{R_6, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
M; \{R_2, R_4\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
& \{R_6, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
Z; \{R_2, R_4\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
& \{R_6, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
A; \{R_2, R_4\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
& \{R_6, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
\Lambda; \{R_2, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
V; \{R_2, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x + c_3k_y) + \sigma_3 (c_4k_x + c_5k_y) + c_6\sigma_1k_z; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x + c_3k_y) + \sigma_3 (c_4k_x + c_5k_y) + c_6\sigma_1k_z; \\
\Lambda; \{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_2, R_4\}; [(A_4 + A_6) c_3 + (A_2 - A_1) c_4] k_x + [(A_1 - A_2) c_3 + (A_4 + A_6) c_4] k_y + A_0 (c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8) c_5k_z; \\
& \{R_2, R_4\}, \{R_3\}; [(A_6 + A_7) c_3 + (A_3 - A_2) c_4] k_x + [(A_2 - A_3) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2k_z) + A_8c_5k_z; \\
V; \{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_2, R_4\}; [(A_4 + A_6) c_3 + (A_2 - A_1) c_4] k_x + [(A_1 - A_2) c_3 + (A_4 + A_6) c_4] k_y + A_0 (c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8) c_5k_z; \\
& \{R_2, R_4\}, \{R_3\}; [(A_6 + A_7) c_3 + (A_3 - A_2) c_4] k_x + [(A_2 - A_3) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2k_z) + A_8c_5k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x + c_3k_y) + \sigma_3 (c_4k_x + c_5k_y) + c_6\sigma_1k_z; \\
S; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x + c_3k_y) + \sigma_3 (c_4k_x + c_5k_y) + c_6\sigma_1k_z; \\
Y; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x + c_3k_y) + \sigma_3 (c_4k_x + c_5k_y) + c_6\sigma_1k_z; \\
T; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x + c_3k_y) + \sigma_3 (c_4k_x + c_5k_y) + c_6\sigma_1k_z; \\
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1 (c_4k_x + c_5k_y);
\end{aligned}$$

SG 84

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{I|00\frac{1}{2}\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_4\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
& \{R_6, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
M; \{R_2, R_4\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
& \{R_6, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
Z; R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + [c_4k_xk_y + c_5(k_x^2 - k_y^2)] \sigma_3; \\
& R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + [c_4k_xk_y + c_5(k_x^2 - k_y^2)] \sigma_3 + c_2\sigma_2k_z; \\
A; R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + [c_4k_xk_y + c_5(k_x^2 - k_y^2)] \sigma_3; \\
& R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + [c_4k_xk_y + c_5(k_x^2 - k_y^2)] \sigma_3 + c_2\sigma_2k_z; \\
\Lambda; \{R_2, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
V; \{R_2, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
U; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
\Lambda; \{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_2, R_4\}; [(A_4 + A_6) c_3 + (A_2 - A_1) c_4] k_x + [(A_1 - A_2) c_3 + (A_4 + A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \quad \{R_2, R_4\}, \{R_3\}; [(A_6 + A_7) c_3 + (A_3 - A_2) c_4] k_x + [(A_2 - A_3) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2 k_z) + A_8 c_5 k_z; \\
V; \{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_2, R_4\}; [(A_4 + A_6) c_3 + (A_2 - A_1) c_4] k_x + [(A_1 - A_2) c_3 + (A_4 + A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \quad \{R_2, R_4\}, \{R_3\}; [(A_6 + A_7) c_3 + (A_3 - A_2) c_4] k_x + [(A_2 - A_3) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2 k_z) + A_8 c_5 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
S; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
Y; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
T; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
W; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sigma_1 (c_4 k_x + c_5 k_y);
\end{aligned}$$

SG 85

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 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_4\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
& \quad \{R_6, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
M; R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [c_4 k_x k_y + c_5(k_x^2 - k_y^2)] \sigma_3; \\
& \quad R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [c_4 k_x k_y + c_5(k_x^2 - k_y^2)] \sigma_3 + c_2 \sigma_2 k_z; \\
Z; \{R_2, R_4\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
& \quad \{R_6, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
A; R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [c_4 k_x k_y + c_5(k_x^2 - k_y^2)] \sigma_3; \\
& \quad R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [c_4 k_x k_y + c_5(k_x^2 - k_y^2)] \sigma_3 + c_2 \sigma_2 k_z; \\
R; R_5; & \quad c_1 \sigma_0 + \sigma_2 (c_2 k_x + c_3 k_y); \\
X; R_5; & \quad c_1 \sigma_0 + \sigma_2 (c_2 k_x + c_3 k_y); \\
\Lambda; \{R_2, R_4\}; & \quad [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
V; \{R_5, R_7\}; & \quad [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
W; \{R_1, R_2\}; & \quad (c_1 + c_2 k_z) \sigma_0 + \sum_{i=1}^2 (c_{i,1} k_x + c_{i,2} k_y) \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
U; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
\Lambda; \{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_2, R_4\}; [(A_4 + A_6) c_3 + (A_2 - A_1) c_4] k_x + [(A_1 - A_2) c_3 + (A_4 + A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \quad \{R_2, R_4\}, \{R_3\}; [(A_6 + A_7) c_3 + (A_3 - A_2) c_4] k_x + [(A_2 - A_3) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2 k_z) + A_8 c_5 k_z; \\
V; \{R_5, R_7\}, \{R_6\}; & \quad [(A_6 + A_7) c_3 + (A_3 - A_2) c_4] k_x + [(A_2 - A_3) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2 k_z) + A_8 c_5 k_z; \\
& \quad \{R_5, R_7\}, \{R_8\}; [(A_6 + A_7) c_3 + (A_2 - A_3) c_4] k_x + [(A_3 - A_2) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2 k_z) + A_8 (c_5 + c_6 k_z); \\
& \quad \{R_6\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
S; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
Y; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
T; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z;
\end{aligned}$$

SG 86

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 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_4\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
& \quad \{R_6, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
M; R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [c_4 k_x k_y + c_5(k_x^2 - k_y^2)] \sigma_3; \\
& \quad R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [c_4 k_x k_y + c_5(k_x^2 - k_y^2)] \sigma_3 + c_2 \sigma_2 k_z; \\
Z; R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [c_4 k_x k_y + c_5(k_x^2 - k_y^2)] \sigma_3; \\
& \quad R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [c_4 k_x k_y + c_5(k_x^2 - k_y^2)] \sigma_3 + c_2 \sigma_2 k_z; \\
A; \{R_2, R_4\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
& \quad \{R_6, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
R; R_5; & \quad c_1 \sigma_0 + \sigma_2 (c_2 k_x + c_3 k_y); \\
X; R_5; & \quad c_1 \sigma_0 + \sigma_2 (c_2 k_x + c_3 k_y); \\
\Lambda; \{R_2, R_4\}; & \quad [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
V; \{R_5, R_7\}; & \quad [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
W; \{R_1, R_2\}; & \quad (c_1 + c_2 k_z) \sigma_0 + \sum_{i=1}^2 (c_{i,1} k_x + c_{i,2} k_y) \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
U; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
\Lambda; \{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_2, R_4\}; [(A_4 + A_6) c_3 + (A_2 - A_1) c_4] k_x + [(A_1 - A_2) c_3 + (A_4 + A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \quad \{R_2, R_4\}, \{R_3\}; [(A_6 + A_7) c_3 + (A_3 - A_2) c_4] k_x + [(A_2 - A_3) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2 k_z) + A_8 c_5 k_z; \\
V; \{R_5, R_7\}, \{R_6\}; & \quad [(A_6 + A_7) c_3 + (A_3 - A_2) c_4] k_x + [(A_2 - A_3) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2 k_z) + A_8 c_5 k_z; \\
& \quad \{R_5, R_7\}, \{R_8\}; [(A_6 + A_7) c_3 + (A_2 - A_3) c_4] k_x + [(A_3 - A_2) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2 k_z) + A_8 (c_5 + c_6 k_z); \\
& \quad \{R_6\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
S; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
Y; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
T; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z;
\end{aligned}$$

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SG 87

$\Gamma_q^v; \{C_{4z}^+ | 000\}, \{I | 000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_4\}; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
& \quad \{R_6, R_8\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
Z; \{R_2, R_4\}; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
& \quad \{R_6, R_8\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
P; \{R_2, R_4\}; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2) + c_{i,3} k_z] \sigma_i; \\
\Lambda; \{R_2, R_4\}; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i; \\
V; \{R_2, R_4\}; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1} k_x k_y + c_{i,2} (k_x^2 - k_y^2)] \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_2, R_4\}; [(A_4 + A_6) c_3 + (A_2 - A_1) c_4] k_x + [(A_1 - A_2) c_3 + (A_4 + A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \quad \{R_2, R_4\}, \{R_3\}; [(A_6 + A_7) c_3 + (A_3 - A_2) c_4] k_x + [(A_2 - A_3) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2 k_z) + A_8 c_5 k_z; \\
V; \{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_2, R_4\}; [(A_4 + A_6) c_3 + (A_2 - A_1) c_4] k_x + [(A_1 - A_2) c_3 + (A_4 + A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \quad \{R_2, R_4\}, \{R_3\}; [(A_6 + A_7) c_3 + (A_3 - A_2) c_4] k_x + [(A_2 - A_3) c_3 + (A_6 + A_7) c_4] k_y + A_0 (c_1 + c_2 k_z) + A_8 c_5 k_z; \\
W; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sigma_1 (c_4 k_x + c_5 k_y); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
F; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
U; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
Y; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z;
\end{aligned}$$

SG 88

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 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{I | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; & \{R_2, R_4\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
& \{R_6, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
X; & R_5; c_1\sigma_0 + \sigma_2(c_2k_x + c_3k_y); \\
Z; & R_9; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + [c_4k_xk_y + c_5(k_x^2 - k_y^2)] \sigma_3; \\
& R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + [c_4k_xk_y + c_5(k_x^2 - k_y^2)] \sigma_3 + c_2\sigma_2k_z; \\
P; & \{R_1, R_4\}; c_2(\sigma_2k_x + \sigma_1k_y) + c_3(\sigma_1k_x + \sigma_2k_y) + c_1\sigma_0; \\
& \{R_2, R_3\}; c_2(\sigma_2k_x + \sigma_1k_y) + c_3(\sigma_1k_x + \sigma_2k_y) + c_1\sigma_0; \\
\Lambda; & \{R_2, R_4\}; [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
V; & \{R_5, R_7\}; [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + \sum_{i=1}^2 [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2)] \sigma_i; \\
W; & \{R_1, R_2\}; (c_1 + c_2k_z)\sigma_0 + (c_4k_x + c_3k_y)\sigma_1 + (c_6k_x + c_5k_y)\sigma_2;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; & \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_2, R_4\}; [(A_4 + A_6)c_3 + (A_2 - A_1)c_4]k_x + [(A_1 - A_2)c_3 + (A_4 + A_6)c_4]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
& \{R_2, R_4\}, \{R_3\}; [(A_6 + A_7)c_3 + (A_3 - A_2)c_4]k_x + [(A_2 - A_3)c_3 + (A_6 + A_7)c_4]k_y + A_0(c_1 + c_2k_z) + A_8c_5k_z; \\
V; & \{R_5, R_7\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5, R_7\}, \{R_8\}; [(A_4 + A_6)c_3 + (A_2 - A_1)c_4]k_x + [(A_1 - A_2)c_3 + (A_4 + A_6)c_4]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
& \{R_6\}, \{R_8\}; [(A_6 + A_7)c_3 + (A_3 - A_2)c_4]k_x + [(A_2 - A_3)c_3 + (A_6 + A_7)c_4]k_y + A_0(c_1 + c_2k_z) + A_8c_5k_z; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x + c_3k_y) + \sigma_3(c_4k_x + c_5k_y) + c_6\sigma_1k_z; \\
F; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x + c_3k_y) + \sigma_3(c_4k_x + c_5k_y) + c_6\sigma_1k_z; \\
\Delta; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x + c_3k_y) + \sigma_3(c_4k_x + c_5k_y) + c_6\sigma_1k_z; \\
U; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x + c_3k_y) + \sigma_3(c_4k_x + c_5k_y) + c_6\sigma_1k_z; \\
Y; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x + c_3k_y) + \sigma_3(c_4k_x + c_5k_y) + c_6\sigma_1k_z;
\end{aligned}$$

SG 89

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 $\Gamma_q; \{C_{4z}^+ | 000\}, \{C_{2x} | 000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; & R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_2\sigma_2k_z; \\
M; & R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_2\sigma_2k_z; \\
Z; & R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_2\sigma_2k_z; \\
A; & R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_2\sigma_2k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1-i)c_5 \sigma_+ k_+ + h.c.]; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
V; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1-i)c_5 \sigma_+ k_+ + h.c.]; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
S; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
T; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x + c_6 \sigma_2 k_y;
\end{aligned}$$

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SG 90

 $\Gamma_q; \{C_{4z}^+ | 000\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 (k_x^2 - k_y^2) \sigma_3 + c_2 \sigma_2 k_z; \\
M; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 (k_x^2 - k_y^2) \sigma_3 + c_2 \sigma_2 k_z; \\
A; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
R; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
X; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
V; \{R_1, R_3\}; & [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + (c_5 \sigma_1 + c_6 \sigma_2) k_x k_y; \\
& \{R_2, R_4\}; [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + (c_5 \sigma_1 + c_6 \sigma_2) k_x k_y; \\
Y; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
T; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
W; \{R_1, R_2\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y;
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z;$
$U; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z;$
$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.];$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.];$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1-i)c_5 \sigma_+ k_+ + h.c.];$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.];$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.];$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.];$
$V; \{R_1, R_3\}, \{R_2, R_4\};$	$\Gamma_{0,0} (c_1 + c_2 k_z) + c_3 \Gamma_{3,0} k_z + \{(1+i)[(c_4 \Gamma_{+,0} + i c_5 \Gamma_{+,3}) k_- + i k_+ (c_6 \Gamma_{+,1} + c_7 \Gamma_{+,2})] + h.c.\};$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x);$
$S; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x);$

SG 91

 $\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{4}\}, \{C_{2x} | 000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_6\sigma_2k_z; \\
M; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_6\sigma_2k_z; \\
Z; R_6; & c_1\sigma_0 + c_2\sigma_2k_z; \\
& R_7; & c_1\sigma_0 + c_2\sigma_2k_z; \\
A; R_6; & c_1\sigma_0 + c_2\sigma_2k_z; \\
& R_7; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
U; \{R_2, R_4\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
S; \{R_2, R_6\}; & (c_1 + c_2k_x + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
T; \{R_1, R_2\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x + c_6\sigma_2k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\
& \{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3 (c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+ (\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + [(1-i)c_5\sigma_+k_+ + h.c.]; \\
& \{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\
& \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3 (c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+ (\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\
V; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\
& \{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3 (c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+ (\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + [(1-i)c_5\sigma_+k_+ + h.c.]; \\
& \{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\
& \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3 (c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+ (\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x + c_2k_y) + \sigma_3 (c_3k_x + c_3k_y) + c_4\sigma_1k_z + c_5\sigma_2 (k_y - k_x); \\
Y; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x) + c_3\sigma_3k_x + c_6\sigma_2k_y + c_5\sigma_1k_z; \\
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_x + c_6\sigma_2k_y;
\end{aligned}$$

SG 92

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 $\Gamma_q; \{C_{4z}^+ | 00\frac{1}{4}\}, \{C_{2x} | \frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1 k_x k_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_6\sigma_2 k_z; \\
M; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_x k_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_x k_y; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3 k_x k_y; \\
Z; R_6; & c_1\sigma_0 + c_2\sigma_2 k_z; \\
R_7; & c_1\sigma_0 + c_2\sigma_2 k_z; \\
A; \{R_6, R_7\}; & c_1\Gamma_{0,0} + c_2[\Gamma_{0,2}(k_x - k_y) + \Gamma_{3,3}(k_x + k_y)] + c_3\Gamma_{3,1}k_z; \\
R; \{R_2, R_4\}; & (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_y k_z; \\
& \{R_6, R_8\}; (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_y k_z; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2 k_y; \\
U; \{R_2, R_4\}; & (c_1 + c_2 k_y) \sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
V; \{R_1, R_3\}; & [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_x k_y; \\
& \{R_2, R_4\}; [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_x k_y; \\
S; \{R_2, R_6\}; & (c_1 + c_2 k_x + c_2 k_y) \sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_z; \\
Y; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
T; \{R_2, R_2\}; & (c_1 + c_2 k_x + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_y k_z; \\
& \{R_4, R_4\}; (c_1 + c_2 k_x + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_y k_z; \\
W; \{R_1, R_2\}; & (c_1 + c_2 k_z) \sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3\sigma_3 k_y + c_5\sigma_1 k_x + c_6\sigma_2 k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3\sigma_3 k_z + [(1+i)c_5\sigma_+ k_- + h.c.]; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3\sigma_3 k_z + [(1-i)c_5\sigma_+ k_+ + h.c.]; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3\sigma_3 k_z + [(1+i)c_5\sigma_+ k_- + h.c.]; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3\sigma_3 k_z + [(1+i)c_5\sigma_+ k_- + h.c.]; \\
V; \{R_1, R_3\}, \{R_2, R_4\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + c_3\Gamma_{3,0} k_z + \{(1+i)[(c_4\Gamma_{+,0} + ic_5\Gamma_{+,3})k_- + ik_+ (c_6\Gamma_{+,1} + c_7\Gamma_{+,2})] + h.c.\}; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4\sigma_1 k_z + c_5\sigma_2 (k_y - k_x); \\
T; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + c_4\Gamma_{1,0} k_z + c_5\Gamma_{2,0} k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{1,i} k_y + c_{i,2}\Gamma_{2,i} k_z);
\end{aligned}$$

SG 93

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 $\Gamma_q; \{C_{4z}^+ | 00\frac{1}{2}\}, \{C_{2x} | 000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1 k_x k_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_6\sigma_2 k_z; \\
M; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1 k_x k_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_6\sigma_2 k_z; \\
Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1 k_x k_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_6\sigma_2 k_z; \\
A; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1 k_x k_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_6\sigma_2 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1-i)c_5 \sigma_+ k_+ + h.c.]; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
V; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1-i)c_5 \sigma_+ k_+ + h.c.]; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
T; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x + c_6 \sigma_2 k_y;
\end{aligned}$$

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SG 94

 $\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 (k_x^2 - k_y^2) \sigma_3 + c_6 \sigma_2 k_z; \\
M; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 (k_x^2 - k_y^2) \sigma_3 + c_6 \sigma_2 k_z; \\
A; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
R; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
X; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
V; \{R_1, R_3\}; & [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + (c_5 \sigma_1 + c_6 \sigma_2) k_x k_y; \\
& \{R_2, R_4\}; [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + (c_5 \sigma_1 + c_6 \sigma_2) k_x k_y; \\
Y; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
T; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
W; \{R_1, R_2\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z;$
$U; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z;$
$\Lambda; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.];$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.];$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1-i)c_5 \sigma_+ k_+ + h.c.];$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.];$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.];$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.];$
$V; \{R_1, R_3\}, \{R_2, R_4\};$	$\Gamma_{0,0} (c_1 + c_2 k_z) + c_3 \Gamma_{3,0} k_z + \{(1+i)[(c_4 \Gamma_{+,0} + i c_5 \Gamma_{+,3}) k_- + i k_+ (c_6 \Gamma_{+,1} + c_7 \Gamma_{+,2})] + h.c.\};$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x);$
$S; \{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x);$

SG 95

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 $\Gamma_q; \{C_{4z}^+ | 00 \frac{3}{4}\}, \{C_{2x} | 000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; R_5;$	$[c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 (k_x^2 - k_y^2) \sigma_3 + c_6 \sigma_2 k_z;$
$M; R_5;$	$[c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 (k_x^2 - k_y^2) \sigma_3 + c_6 \sigma_2 k_z;$
$Z; R_6;$	$c_1 \sigma_0 + c_2 \sigma_2 k_z;$
$R_7;$	$c_1 \sigma_0 + c_2 \sigma_2 k_z;$
$A; R_6;$	$c_1 \sigma_0 + c_2 \sigma_2 k_z;$
$R_7;$	$c_1 \sigma_0 + c_2 \sigma_2 k_z;$
$R; R_5;$	$c_1 \sigma_0 + c_2 \sigma_2 k_z;$
$U; \{R_2, R_4\};$	$(c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z;$
$S; \{R_4, R_8\};$	$(c_1 + c_2 k_x + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z;$
$T; \{R_1, R_2\};$	$(c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z;$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1-i)c_5 \sigma_+ k_+ + h.c.]; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
V; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1-i)c_5 \sigma_+ k_+ + h.c.]; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
W; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x + c_6 \sigma_2 k_y;
\end{aligned}$$

SG 96

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 $\Gamma_q; \{C_{4z}^+ | 00 \frac{3}{4}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; & R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 (k_x^2 - k_y^2) \sigma_3 + c_6 \sigma_2 k_z; \\
M; & \{R_5, R_6\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
Z; & R_6; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& R_7; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
A; & \{R_6, R_7\}; c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,2}(k_x - k_y) + \Gamma_{3,3}(k_x + k_y)] + c_3 \Gamma_{3,1} k_z; \\
R; & \{R_2, R_4\}; (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_y k_z; \\
& \{R_6, R_8\}; (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_y k_z; \\
X; & R_5; c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
U; & \{R_2, R_4\}; (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
V; & \{R_1, R_3\}; [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_x k_y; \\
& \{R_2, R_4\}; [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_x k_y; \\
S; & \{R_4, R_8\}; (c_1 + c_2 k_x + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
Y; & \{R_2, R_4\}; (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
T; & \{R_2, R_2\}; (c_1 + c_2 k_x + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_y k_z; \\
& \{R_4, R_4\}; (c_1 + c_2 k_x + \sum_{i=x}^z c_i k_i^2) \sigma_0 + \sum_{i=1}^3 c_i \sigma_i k_y k_z; \\
W; & \{R_1, R_2\}; (c_1 + c_2 k_z) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1-i)c_5 \sigma_+ k_+ + h.c.]; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
V; \{R_1, R_3\}, \{R_2, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + c_3 \Gamma_{3,0} k_z + \{(1+i)[(c_4 \Gamma_{+,0} + i c_5 \Gamma_{+,3}) k_- + i k_+ (c_6 \Gamma_{+,1} + c_7 \Gamma_{+,2})] + h.c.\}; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
T; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + c_4 \Gamma_{1,0} k_z + c_5 \Gamma_{2,0} k_y + \sum_{i=1}^3 (c_{i,1} \Gamma_{1,i} k_y + c_{i,2} \Gamma_{2,i} k_z);
\end{aligned}$$

SG 97

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 $\Gamma_q^v; \{C_{4z}^+ | 000\}, \{C_{2x} | 000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 (k_x^2 - k_y^2) \sigma_3 + c_6 \sigma_2 k_z; \\
Z; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 (k_x^2 - k_y^2) \sigma_3 + c_6 \sigma_2 k_z; \\
P; \{R_3, R_4\}; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sum_{i=1}^2 (c_{i,1} k_x k_y + c_{i,2} k_z) \sigma_i + c_4 (k_x^2 - k_y^2) \sigma_3;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1-i)c_5 \sigma_+ k_+ + h.c.]; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
V; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1-i)c_5 \sigma_+ k_+ + h.c.]; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + [(1+i)c_5 \sigma_+ k_- + h.c.]; \\
W; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x + k_y) + c_6 \sigma_2 (k_y - k_x); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
F; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
Q; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
U; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 (c_3 k_x - c_3 k_y) + c_4 \sigma_1 (k_x + k_y) + c_6 \sigma_2 k_z;
\end{aligned}$$

SG 98

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 $\Gamma_q; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{C_{2x} | 0 \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned} \Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_6\sigma_2k_z; \\ Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3 + c_6\sigma_2k_z; \\ P; R_{10}; & c_1\sigma_0 + c_2(\sigma_2k_x - \sigma_3k_y) + c_3\sigma_1k_z; \end{aligned}$$

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 Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\ & \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\ & \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + [(1-i)c_5\sigma_+k_+ + h.c.]; \\ & \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\ & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\ & \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\ V; & \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\ & \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\ & \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + [(1-i)c_5\sigma_+k_+ + h.c.]; \\ & \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\ & \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\ & \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + [(1+i)c_5\sigma_+k_- + h.c.]; \\ W; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1(k_x + k_y) + c_6\sigma_2(k_y - k_x); \\ \Sigma; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_6\sigma_2k_y + c_5\sigma_1k_z; \\ F; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_6\sigma_2k_y + c_5\sigma_1k_z; \\ Q; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_z); \\ \Delta; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_1k_z + c_5\sigma_2(k_y - k_x); \\ U; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_1k_z + c_5\sigma_2(k_y - k_x); \\ Y; & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x - c_2k_y) + \sigma_3(c_3k_x - c_3k_y) + c_4\sigma_1(k_x + k_y) + c_6\sigma_2k_z; \end{aligned}$$

SG 99

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 $\Gamma_q; \{C_{4z}^+ | 000\}, \{\sigma_y | 000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned} \Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3; \\ M; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3; \\ Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3; \\ A; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3; \\ \Lambda; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6(k_x^2 - k_y^2)\sigma_3; \\ V; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6(k_x^2 - k_y^2)\sigma_3; \end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
U; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
S; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y; \\
T; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y; \\
W; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; \{R_5, R_6\}; & c_2\sigma_3k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; c_2\sigma_3k_z + c_1\sigma_0; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3; \\
Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_1k_xk_y + c_5(k_x^2 - k_y^2)\sigma_3; \\
A; \{R_5, R_6\}; & c_2\sigma_3k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; c_2\sigma_3k_z + c_1\sigma_0; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3; \\
R; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
\Lambda; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6(k_x^2 - k_y^2)\sigma_3; \\
V; R_9; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3k_xk_y + c_6(k_x^2 - k_y^2)\sigma_2; \\
Y; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
T; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
W; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_y;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
U; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_5\}; (A_4c_3 - A_1c_5)k_x + (A_2c_5 - A_6c_3)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_2\}, \{R_5\}; c_5(A_2k_x + A_1k_y) + c_3(A_6k_x + A_4k_y) + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_3\}, \{R_5\}; c_5(A_1k_x + A_2k_y) + c_3(A_4k_x + A_6k_y) + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_4\}, \{R_5\}; (A_6c_3 - A_2c_5)k_x + (A_1c_5 - A_4c_3)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
V; \{R_5\}, \{R_6\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5\}, \{R_9\}; [(A_2 + A_4)c_3 + (A_6 - A_1)c_4]k_x + [(A_2 - A_4)c_3 + (A_1 + A_6)c_4]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
& \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_6\}, \{R_9\}; [(A_4 - A_2)c_3 + (A_1 + A_6)c_4]k_x + [(A_2 + A_4)c_3 + (A_1 - A_6)c_4]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
& \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_7\}, \{R_9\}; [(A_2 + A_4)c_3 + (A_6 - A_1)c_4]k_x + [(A_2 - A_4)c_3 + (A_1 + A_6)c_4]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
& \{R_8\}, \{R_9\}; [(A_4 - A_2)c_3 + (A_1 + A_6)c_4]k_x + [(A_2 + A_4)c_3 + (A_1 - A_6)c_4]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_2(k_y - k_x); \\
S; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_2(k_y - k_x);
\end{aligned}$$

SG 101

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 $\Gamma_q; \{C_{4z}^+ | 00\frac{1}{2}\}, \{\sigma_y | 00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\Gamma; R_5; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3;$$

$$M; R_5; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3;$$

$$Z; \{R_5, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z;$$

$$\{R_7, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z;$$

$$R_9; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3;$$

$$A; \{R_5, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z;$$

$$\{R_7, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z;$$

$$R_9; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3;$$

$$R; \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z;$$

$$\{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z;$$

$$U; \{R_1, R_2\}; (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z;$$

$$\Lambda; R_5; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6(k_x^2 - k_y^2)\sigma_3;$$

$$V; R_5; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6(k_x^2 - k_y^2)\sigma_3;$$

$$T; \{R_1, R_2\}; (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z;$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
S; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y; \\
W; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{\sigma_y | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
M; \{R_5, R_6\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_7, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_3; \\
Z; \{R_5, R_6\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_7, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_3; \\
A; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_3 + c_5 (k_x^2 - k_y^2) \sigma_1; \\
R; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_x; \\
X; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
U; \{R_1, R_2\}; & (c_1 + c_2 k_y) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_x + c_5 \sigma_3 k_z; \\
\Lambda; R_5; & [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 k_x k_y \sigma_1 + c_6 (k_x^2 - k_y^2) \sigma_3; \\
V; R_9; & [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 k_x k_y \sigma_3 + c_6 (k_x^2 - k_y^2) \sigma_2; \\
Y; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y + c_5 \sigma_3 k_z; \\
W; R_5; & (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_2 k_x + c_4 \sigma_1 k_y;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_5\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_5\}, \{R_9\}; [(A_4 - A_2) c_3 + (A_1 + A_6) c_4] k_x - [(A_2 + A_4) c_3 + (A_1 - A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_6\}, \{R_9\}; [(A_2 + A_4) c_3 + (A_6 - A_1) c_4] k_x + [(A_2 - A_4) c_3 + (A_1 + A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_7\}, \{R_9\}; [(A_4 - A_2) c_3 + (A_1 + A_6) c_4] k_x + [(A_2 + A_4) c_3 + (A_1 - A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \{R_8\}, \{R_9\}; [(A_2 + A_4) c_3 + (A_6 - A_1) c_4] k_x - [(A_2 - A_4) c_3 + (A_1 + A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
S; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
T; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y;
\end{aligned}$$

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 $\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
Z; \{R_5, R_6\}; & \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
& \quad \{R_7, R_8\}; \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
& \quad \{R_{10}, R_{10}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}\Gamma_{i,0}k_z + c_{i,2}\Gamma_{i,1}(k_x^2 - k_y^2) + c_{i,3}\Gamma_{i,2}k_xk_y]; \\
A; \{R_5, R_6\}; & \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
& \quad \{R_7, R_8\}; \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
& \quad \{R_{10}, R_{10}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}\Gamma_{i,0}k_z + c_{i,2}\Gamma_{i,1}(k_x^2 - k_y^2) + c_{i,3}\Gamma_{i,2}k_xk_y]; \\
R; \{R_2, R_4\}; & \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
& \quad \{R_6, R_8\}; \quad c_1\sigma_0 + c_2\sigma_3k_z; \\
U; \{R_1, R_2\}; & \quad (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z; \\
\Lambda; R_5; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_1 + c_6(k_x^2 - k_y^2)\sigma_3; \\
V; R_5; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_1 + c_6(k_x^2 - k_y^2)\sigma_3; \\
S; \{R_1, R_2\}; & \quad [c_1 + c_2(k_x + k_y)]\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)(k_x - k_y) + c_5\sigma_3k_z; \\
T; \{R_1, R_2\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y; \\
W; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

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 $\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; \{R_5, R_6\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_7, R_8\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3; \\
Z; \{R_5, R_6\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_7, R_8\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_{10}, R_{10}\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}\Gamma_{i,0}k_z + c_{i,2}\Gamma_{i,1}(k_x^2 - k_y^2) + c_{i,3}\Gamma_{i,2}k_xk_y]; \\
A; \{R_5, R_6\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_7, R_8\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4(k_x^2 - k_y^2)\sigma_3; \\
R; R_5; & c_1\sigma_0 + c_2\sigma_2k_x; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
U; \{R_1, R_2\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z; \\
\Lambda; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_1 + c_6(k_x^2 - k_y^2)\sigma_3; \\
V; R_9; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_3 + c_6(k_x^2 - k_y^2)\sigma_2; \\
S; \{R_1, R_2\}; & [c_1 + c_2(k_x + k_y)]\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)(k_x - k_y) + c_5\sigma_3k_z; \\
Y; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
W; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_y;
\end{aligned}$$



Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0(c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; c_5(A_2 k_x + A_1 k_y) + c_3(A_6 k_x + A_4 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; c_5(A_1 k_x + A_2 k_y) + c_3(A_4 k_x + A_6 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\quad \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0(c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&V; \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_9\}; [(A_4 - A_2) c_3 + (A_1 + A_6) c_4] k_x - [(A_2 + A_4) c_3 + (A_1 - A_6) c_4] k_y + A_0(c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_9\}; [(A_2 + A_4) c_3 + (A_6 - A_1) c_4] k_x + [(A_2 - A_4) c_3 + (A_1 + A_6) c_4] k_y + A_0(c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_7\}, \{R_9\}; [(A_4 - A_2) c_3 + (A_1 + A_6) c_4] k_x + [(A_2 + A_4) c_3 + (A_1 - A_6) c_4] k_y + A_0(c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
&\quad \{R_8\}, \{R_9\}; [(A_2 + A_4) c_3 + (A_6 - A_1) c_4] k_x - [(A_2 - A_4) c_3 + (A_1 + A_6) c_4] k_y + A_0(c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x + c_2 k_y) + \sigma_3(c_3 k_x + c_3 k_y) + c_4 \sigma_2(k_y - k_x); \\
&T; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y;
\end{aligned}$$

SG 105

$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{\sigma_y | 000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5(k_x^2 - k_y^2) \sigma_3; \\
&M; R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5(k_x^2 - k_y^2) \sigma_3; \\
&Z; \{R_5, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&\quad \{R_7, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&\quad R_9; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4(k_x^2 - k_y^2) \sigma_3; \\
&A; \{R_5, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&\quad \{R_7, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&\quad R_9; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4(k_x^2 - k_y^2) \sigma_3; \\
&\Lambda; R_5; [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 k_x k_y \sigma_1 + c_6(k_x^2 - k_y^2) \sigma_3; \\
&V; R_5; [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 k_x k_y \sigma_1 + c_6(k_x^2 - k_y^2) \sigma_3; \\
&S; \{R_1, R_2\}; [c_1 + c_2(k_x + k_y)] \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2)(k_x - k_y) + c_5 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
U; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y; \\
T; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y; \\
W; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

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 $\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{\sigma_y | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; \{R_5, R_6\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_7, R_8\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3; \\
Z; \{R_5, R_6\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_7, R_8\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4(k_x^2 - k_y^2)\sigma_3; \\
A; \{R_5, R_6\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_7, R_8\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_{10}, R_{10}\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}\Gamma_{i,0}k_z + c_{i,2}\Gamma_{i,1}(k_x^2 - k_y^2) + c_{i,3}\Gamma_{i,2}k_xk_y]; \\
R; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
\Lambda; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_1 + c_6(k_x^2 - k_y^2)\sigma_3; \\
V; R_9; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_3 + c_6(k_x^2 - k_y^2)\sigma_2; \\
S; \{R_1, R_2\}; & [c_1 + c_2(k_x + k_y)]\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)(k_x - k_y) + c_5\sigma_3k_z; \\
Y; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
T; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
W; R_5; & (c_1 + c_2k_z)\sigma_0 + c_4\sigma_2k_x + c_2\sigma_1k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_5\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_5\}, \{R_9\}; [(A_4 - A_2) c_3 + (A_1 + A_6) c_4] k_x - [(A_2 + A_4) c_3 + (A_1 - A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_6\}, \{R_9\}; [(A_2 + A_4) c_3 + (A_6 - A_1) c_4] k_x + [(A_2 - A_4) c_3 + (A_1 + A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_7\}, \{R_9\}; [(A_4 - A_2) c_3 + (A_1 + A_6) c_4] k_x + [(A_2 + A_4) c_3 + (A_1 - A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
& \{R_8\}, \{R_9\}; [(A_2 + A_4) c_3 + (A_6 - A_1) c_4] k_x - [(A_2 - A_4) c_3 + (A_1 + A_6) c_4] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x);
\end{aligned}$$

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SG 107

 $\Gamma_q^v; \{C_{4z}^+ | 000\}, \{\sigma_y | 000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

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$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
Z; R_5; & [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
P; \{R_3, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
\Lambda; R_5; & [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 k_x k_y \sigma_1 + c_6 (k_x^2 - k_y^2) \sigma_3; \\
V; R_5; & [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 k_x k_y \sigma_1 + c_6 (k_x^2 - k_y^2) \sigma_3;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
W; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x + k_y); \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x + k_y); \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x - k_y); \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x + k_y); \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\Sigma; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y; \\
F; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y; \\
\Delta; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
U; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 (c_3 k_x - c_3 k_y) + c_4 \sigma_1 (k_x + k_y);
\end{aligned}$$

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 $\Gamma_q^v; \{C_{4z}^+|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\Gamma; R_5; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3;$$

$$N; \{R_2, R_4\}; c_1\sigma_0 + (c_2k_x + c_3k_z)\sigma_3;$$

$$Z; R_5; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3;$$

$$P; \{R_1, R_3\}; c_1\sigma_0 + c_2\sigma_3k_z;$$

$$\{R_2, R_2\}; c_1\sigma_0 + \sum_{i=1}^3 c_{i,1}\sigma_i k_z;$$

$$\{R_4, R_4\}; c_1\sigma_0 + \sum_{i=1}^3 c_{i,1}\sigma_i k_z;$$

$$\Lambda; R_5; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_1 + c_6(k_x^2 - k_y^2)\sigma_3;$$

$$V; R_5; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_1 + c_6(k_x^2 - k_y^2)\sigma_3;$$

$$Q; \{R_1, R_1\}; (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^3 (c_{i,1}k_x + c_{i,2}k_z)\sigma_i;$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; (A_4 c_3 - A_1 c_5) k_x + (A_2 c_5 - A_6 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_5 (A_2 k_x + A_1 k_y) + c_3 (A_6 k_x + A_4 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_5 (A_1 k_x + A_2 k_y) + c_3 (A_4 k_x + A_6 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; (A_6 c_3 - A_2 c_5) k_x + (A_1 c_5 - A_4 c_3) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
W; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x + k_y); \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x + k_y); \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x - k_y); \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x + k_y); \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\Sigma; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y; \\
F; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y; \\
\Delta; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
U; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; \quad & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 (c_3 k_x - c_3 k_y) + c_4 \sigma_1 (k_x + k_y);
\end{aligned}$$

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 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{\sigma_y | 000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
X; R_5; & c_1\sigma_0 + c_2(k_x + k_y)\sigma_2; \\
Z; \{R_5, R_6\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_7, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4(k_x^2 - k_y^2)\sigma_3; \\
P; R_{10}; & c_1\sigma_0 + c_2[(\sigma_1 - \sigma_3)k_x + (\sigma_1 + \sigma_3)k_y]; \\
\Lambda; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_1 + c_6(k_x^2 - k_y^2)\sigma_3; \\
V; R_9; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_2 + c_6(k_x^2 - k_y^2)\sigma_3; \\
W; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1(k_x + k_y) + c_4\sigma_2(k_x - k_y); \\
U; \{R_1, R_2\}; & [c_1 + c_2(k_x + k_y)]\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)(k_x - k_y) + c_5\sigma_3k_z; \\
Y; \{R_2, R_4\}; & [c_1 + c_2(k_x - k_y)]\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)(k_x + k_y) + c_5\sigma_3k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_5\}; (A_4c_3 - A_1c_5)k_x + (A_2c_5 - A_6c_3)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_2\}, \{R_5\}; c_5(A_2k_x + A_1k_y) + c_3(A_6k_x + A_4k_y) + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_3\}, \{R_5\}; c_5(A_1k_x + A_2k_y) + c_3(A_4k_x + A_6k_y) + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_4\}, \{R_5\}; (A_6c_3 - A_2c_5)k_x + (A_1c_5 - A_4c_3)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
V; \{R_5\}, \{R_6\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5\}, \{R_9\}; (A_4c_3 + A_1c_4)k_x + (A_6c_4 - A_2c_3)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
& \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_6\}, \{R_9\}; (A_4c_3 - A_1c_4)k_x + (A_2c_3 + A_6c_4)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
& \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_7\}, \{R_9\}; (A_6c_3 - A_2c_4)k_x + (A_1c_3 + A_4c_4)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
& \{R_8\}, \{R_9\}; (A_6c_3 + A_2c_4)k_x + (A_4c_4 - A_1c_3)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_2k_y; \\
F; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_2k_y; \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_2(k_y - k_x);
\end{aligned}$$



$\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{\sigma_y | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
N; \{R_2, R_4\}; & c_1\sigma_0 + (c_2k_x + c_3k_z)\sigma_3; \\
X; R_5; & c_1\sigma_0 + c_2(k_x + k_y)\sigma_2; \\
Z; \{R_5, R_6\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
& \{R_7, R_8\}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4(k_x^2 - k_y^2)\sigma_3; \\
P; \{R_{10}, R_{10}\}; & c_1\Gamma_{0,0} + c_2[(k_x + k_y)\Gamma_{0,1} + (k_x - k_y)\Gamma_{0,3}] + \sum_{i=1}^3 c_{i,1}[(k_x + k_y)\Gamma_{i,1} - (k_x - k_y)\Gamma_{i,3} + k_z\Gamma_{i,0}]; \\
\Lambda; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_1 + c_6(k_x^2 - k_y^2)\sigma_3; \\
V; R_9; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5k_xk_y\sigma_2 + c_6(k_x^2 - k_y^2)\sigma_3; \\
W; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3(k_x + k_y)\sigma_1 + c_4(k_x - k_y)\sigma_2; \\
Q; \{R_1, R_1\}; & (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^3 (c_{i,1}k_x + c_{i,2}k_z)\sigma_i; \\
U; \{R_1, R_2\}; & [c_1 + c_2(k_x + k_y)]\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)(k_x - k_y) + c_5\sigma_3k_z; \\
Y; \{R_2, R_4\}; & [c_1 + c_2(k_x - k_y)]\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)(k_x + k_y) + c_5\sigma_3k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_5\}; & (A_4c_3 - A_1c_5)k_x + (A_2c_5 - A_6c_3)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_2\}, \{R_3\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_2\}, \{R_5\}; & c_5(A_2k_x + A_1k_y) + c_3(A_6k_x + A_4k_y) + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_3\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_3\}, \{R_5\}; & c_5(A_1k_x + A_2k_y) + c_3(A_4k_x + A_6k_y) + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_4\}, \{R_5\}; & (A_6c_3 - A_2c_5)k_x + (A_1c_5 - A_4c_3)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
V; \{R_5\}, \{R_6\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5\}, \{R_7\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5\}, \{R_8\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_5\}, \{R_9\}; & (A_4c_3 + A_1c_4)k_x + (A_6c_4 - A_2c_3)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
& \{R_6\}, \{R_7\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_6\}, \{R_8\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_6\}, \{R_9\}; & (A_4c_3 - A_1c_4)k_x + (A_2c_3 + A_6c_4)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
& \{R_7\}, \{R_8\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_7\}, \{R_9\}; & (A_6c_3 - A_2c_4)k_x + (A_1c_3 + A_4c_4)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
& \{R_8\}, \{R_9\}; & (A_6c_3 + A_2c_4)k_x + (A_4c_4 - A_1c_3)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_2k_y; \\
F; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_2k_y; \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_2(k_y - k_x);
\end{aligned}$$

## SG 111

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
A; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
\Lambda; \{R_3, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3k_xk_y + (c_6\sigma_1 + c_7\sigma_2)(k_x^2 - k_y^2); \\
V; \{R_3, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3k_xk_y + (c_6\sigma_1 + c_7\sigma_2)(k_x^2 - k_y^2);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x + c_6\sigma_2k_z; \\
U; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x + c_6\sigma_2k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3, R_4\}; [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_x - [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_2\}, \{R_3, R_4\}; [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_x + [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
V; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3, R_4\}; [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_x - [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_2\}, \{R_3, R_4\}; [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_x + [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_2(k_y - k_x); \\
S; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_2(k_y - k_x); \\
Y; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_6\sigma_2k_y + c_5\sigma_1k_z; \\
T; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_6\sigma_2k_y + c_5\sigma_1k_z; \\
W; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\sigma_1k_x + c_6\sigma_2k_y;
\end{aligned}$$

## SG 112

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
Z; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (4_3\sigma_1 + c_5\sigma_2)(k_x^2 - k_y^2); \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (4_3\sigma_1 + c_5\sigma_2)(k_x^2 - k_y^2); \\
R_9; & c_1\sigma_0 + c_2\sigma_2k_z; \\
A; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (4_3\sigma_1 + c_5\sigma_2)(k_x^2 - k_y^2); \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (4_3\sigma_1 + c_5\sigma_2)(k_x^2 - k_y^2); \\
R_9; & c_1\sigma_0 + c_2\sigma_2k_z; \\
\Lambda; \{R_3, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3k_xk_y + (c_6\sigma_1 + c_7\sigma_2)(k_x^2 - k_y^2); \\
V; \{R_3, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3k_xk_y + (c_6\sigma_1 + c_7\sigma_2)(k_x^2 - k_y^2); \\
S; \{R_1, R_2\}; & [c_1 + c_2(k_x + k_y)] \sigma_0 + (c_3\sigma_1 + c_4\sigma_2)(k_x - k_y) + c_5\sigma_3k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
U; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_3, R_4\}; [(A_4 + A_6) c_3 + (A_2 - A_1) c_6] k_x - [(A_6 - A_4) c_3 + (A_1 + A_2) c_6] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \quad \{R_2\}, \{R_3, R_4\}; [(A_6 - A_4) c_3 + (A_1 + A_2) c_6] k_x + [(A_4 + A_6) c_3 + (A_2 - A_1) c_6] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_3, R_4\}; [(A_4 + A_6) c_3 + (A_2 - A_1) c_6] k_x - [(A_6 - A_4) c_3 + (A_1 + A_2) c_6] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \quad \{R_2\}, \{R_3, R_4\}; [(A_6 - A_4) c_3 + (A_1 + A_2) c_6] k_x + [(A_4 + A_6) c_3 + (A_2 - A_1) c_6] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
T; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
W; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x + c_6 \sigma_2 k_y;
\end{aligned}$$

SG 113

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 $\Gamma_q; \{S_{4z}^+ | 000\}, \{C_{2x} | \frac{1}{2} 0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
M; \{R_5, R_6\}; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
& \quad \{R_7, R_8\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
R_9; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
Z; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
A; \{R_5, R_6\}; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
& \quad \{R_7, R_8\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
R_9; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
R; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
X; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
\Lambda; \{R_3, R_4\}; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_3 k_x k_y + (c_6 \sigma_1 + c_7 \sigma_2) (k_x^2 - k_y^2); \\
V; \{R_1, R_2\}; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_3 k_x k_y; \\
& \quad \{R_3, R_3\}; [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_x k_y; \\
& \quad \{R_4, R_4\}; [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_x k_y; \\
Y; \{R_2, R_4\}; & \quad (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
T; \{R_2, R_4\}; & \quad (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
W; \{R_1, R_2\}; & \quad (c_1 + c_2 k_z) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
U; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_3, R_4\}; \quad [(A_4 + A_6) c_3 + (A_2 - A_1) c_6] k_x - [(A_6 - A_4) c_3 + (A_1 + A_2) c_6] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \quad \{R_2\}, \{R_3, R_4\}; \quad [(A_6 - A_4) c_3 + (A_1 + A_2) c_6] k_x + [(A_4 + A_6) c_3 + (A_2 - A_1) c_6] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_1, R_2\}, \{R_3, R_3\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + k_x (c_2 \Gamma_{2,1} + c_3 \Gamma_{2,2}) + c_4 (\Gamma_{1,0} k_x + \Gamma_{1,3} k_y) + c_5 (\Gamma_{2,3} k_x + \Gamma_{2,0} k_y) - \\
& \quad k_y (c_6 \Gamma_{1,1} - c_7 \Gamma_{1,2}); \\
& \quad \{R_1, R_2\}, \{R_4, R_4\}; \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + k_x (c_2 \Gamma_{1,1} - c_3 \Gamma_{1,2}) + c_4 (\Gamma_{1,3} k_x - \Gamma_{1,0} k_y) + c_5 (\Gamma_{2,3} k_y - \Gamma_{2,0} k_x) + \\
& \quad k_y (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}); \\
& \quad \{R_3, R_3\}, \{R_4, R_4\}; \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (c_2 \Gamma_{0,3} + c_3 \Gamma_{3,3}) k_x k_y + (c_4 \Gamma_{1,3} + c_5 \Gamma_{2,0}) (k_x^2 - k_y^2) + \\
& \quad [(\alpha_1 \Gamma_{0,+} + \alpha_2 \Gamma_{3,+}) k_x k_y + \alpha_3 \Gamma_{1,+} (k_x^2 - k_y^2) + h.c.]; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x); \\
S; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x);
\end{aligned}$$

SG 114

 $\Gamma_q; \{S_{4z}^+ | 000\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
M; \{R_5, R_6\}; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_x k_y; \\
& \quad R_9; \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
Z; \{R_5, R_6\}; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) (k_x^2 - k_y^2); \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) (k_x^2 - k_y^2); \\
& \quad R_9; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
A; \{R_5, R_6\}; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y k_z; \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y k_z; \\
& \quad \{R_{10}, R_{10}\}; \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \Gamma_{0,0} + c_4 \Gamma_{0,2} k_z + \sum_{i=1}^3 [c_{i,1} \Gamma_{i,1} (k_x^2 - k_y^2) + c_{i,2} \Gamma_{i,2} k_x k_y]; \\
R; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
X; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
\Lambda; \{R_3, R_4\}; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_3 k_x k_y + (c_6 \sigma_1 + c_7 \sigma_2) (k_x^2 - k_y^2); \\
V; \{R_1, R_2\}; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_3 k_x k_y; \\
& \quad \{R_3, R_3\}; \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_x k_y; \\
& \quad \{R_4, R_4\}; \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_x k_y; \\
S; \{R_1, R_2\}; & \quad [c_1 + c_2 (k_x + k_y)] \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) (k_x - k_y) + c_5 \sigma_3 k_z; \\
Y; \{R_2, R_4\}; & \quad (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
T; \{R_1, R_2\}; & \quad (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
W; \{R_1, R_2\}; & \quad (c_1 + c_2 k_z) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
U; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_3, R_4\}; \quad [(A_4 + A_6) c_3 + (A_2 - A_1) c_6] k_x - [(A_6 - A_4) c_3 + (A_1 + A_2) c_6] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \quad \{R_2\}, \{R_3, R_4\}; \quad [(A_6 - A_4) c_3 + (A_1 + A_2) c_6] k_x + [(A_4 + A_6) c_3 + (A_2 - A_1) c_6] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_1, R_2\}, \{R_3, R_3\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + k_x (c_2 \Gamma_{2,1} + c_3 \Gamma_{2,2}) + c_4 (\Gamma_{1,0} k_x + \Gamma_{1,3} k_y) + c_5 (\Gamma_{2,3} k_x + \Gamma_{2,0} k_y) - \\
& \quad k_y (c_6 \Gamma_{1,1} - c_7 \Gamma_{1,2}); \\
& \quad \{R_1, R_2\}, \{R_4, R_4\}; \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + k_x (c_2 \Gamma_{1,1} - c_3 \Gamma_{1,2}) + c_4 (\Gamma_{1,3} k_x - \Gamma_{1,0} k_y) + c_5 (\Gamma_{2,3} k_y - \Gamma_{2,0} k_x) + \\
& \quad k_y (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}); \\
& \quad \{R_3, R_3\}, \{R_4, R_4\}; \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (c_2 \Gamma_{0,3} + c_3 \Gamma_{3,3}) k_x k_y + (c_4 \Gamma_{1,3} + c_5 \Gamma_{2,0}) (k_x^2 - k_y^2) + \\
& \quad [(\alpha_1 \Gamma_{0,+} + \alpha_2 \Gamma_{3,+}) k_x k_y + \alpha_3 \Gamma_{1,+} (k_x^2 - k_y^2) + h.c.]; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_2 (k_y - k_x);
\end{aligned}$$

SG 115

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_3 + c_5 (k_x^2 - k_y^2) \sigma_1; \\
M; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_3 + c_5 (k_x^2 - k_y^2) \sigma_1; \\
Z; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_3 + c_5 (k_x^2 - k_y^2) \sigma_1; \\
A; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_3 + c_5 (k_x^2 - k_y^2) \sigma_1; \\
\Lambda; \{R_3, R_4\}; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_3 (k_x^2 - k_y^2) + (c_6 \sigma_1 + c_7 \sigma_2) k_x k_y; \\
V; \{R_3, R_4\}; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_3 (k_x^2 - k_y^2) + (c_6 \sigma_1 + c_7 \sigma_2) k_x k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_2 k_x; \\
U; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_2 k_x; \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_3, R_4\}; \quad (A_4 c_3 - A_1 c_5) k_x - (A_6 c_3 + A_2 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \quad \{R_2\}, \{R_3, R_4\}; \quad (A_6 c_3 - A_2 c_5) k_x + (A_4 c_3 + A_1 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_3, R_4\}; \quad (A_4 c_3 - A_1 c_5) k_x - (A_6 c_3 + A_2 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \quad \{R_2\}, \{R_3, R_4\}; \quad (A_6 c_3 - A_2 c_5) k_x + (A_4 c_3 + A_1 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
S; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
T; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
W; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \quad \{R_1\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \quad \{R_2\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
& \quad \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
& \quad \{R_3\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

$\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3 + c_5(k_x^2 - k_y^2)\sigma_1; \\
M; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3 + c_5(k_x^2 - k_y^2)\sigma_1; \\
Z; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
R_9; & c_1\sigma_0 + c_2\sigma_2k_z; \\
A; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
R_9; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R; \{R_2, R_4\}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
& \{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_2k_z; \\
U; \{R_1, R_2\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z; \\
\Lambda; \{R_3, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3(k_x^2 - k_y^2) + (c_6\sigma_1 + c_7\sigma_2)k_xk_y; \\
V; \{R_3, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3(k_x^2 - k_y^2) + (c_6\sigma_1 + c_7\sigma_2)k_xk_y; \\
T; \{R_1, R_2\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_2k_x; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3, R_4\}; (A_4c_3 - A_1c_5)k_x - (A_6c_3 + A_2c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_2\}, \{R_3, R_4\}; (A_6c_3 - A_2c_5)k_x + (A_4c_3 + A_1c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
V; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3, R_4\}; (A_4c_3 - A_1c_5)k_x - (A_6c_3 + A_2c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_2\}, \{R_3, R_4\}; (A_6c_3 - A_2c_5)k_x + (A_4c_3 + A_1c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_1k_z + c_5\sigma_2(k_y - k_x); \\
S; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_1k_z + c_5\sigma_2(k_y - k_x); \\
Y; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_1k_y; \\
W; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z;
\end{aligned}$$

$\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3 + c_5(k_x^2 - k_y^2)\sigma_1; \\
M; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
R_9; & c_1\sigma_0 + c_2\sigma_2k_z; \\
Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3 + c_5(k_x^2 - k_y^2)\sigma_1; \\
A; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
R_9; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
\Lambda; \{R_3, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3(k_x^2 - k_y^2) + (c_6\sigma_1 + c_7\sigma_2)k_xk_y; \\
V; \{R_6, R_8\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3(k_x^2 - k_y^2) + (c_6\sigma_1 + c_7\sigma_2)k_xk_y; \\
Y; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
T; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
W; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_y;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_2k_x; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_2k_x; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3, R_4\}; (A_4c_3 - A_1c_5)k_x - (A_6c_3 + A_2c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_2\}, \{R_3, R_4\}; (A_6c_3 - A_2c_5)k_x + (A_4c_3 + A_1c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
V; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_2\}, \{R_6, R_8\}; (A_6c_3 - A_2c_5)k_x + (A_4c_3 + A_1c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_4\}, \{R_6, R_8\}; (A_4c_3 - A_1c_5)k_x - (A_6c_3 + A_2c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x + c_2k_y) + \sigma_3 (c_3k_x + c_3k_y) + c_4\sigma_1k_z + c_5\sigma_2(k_y - k_x); \\
S; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x + c_2k_y) + \sigma_3 (c_3k_x + c_3k_y) + c_4\sigma_1k_z + c_5\sigma_2(k_y - k_x);
\end{aligned}$$

SG 118

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3 + c_5(k_x^2 - k_y^2)\sigma_1; \\
M; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
R_9; & c_1\sigma_0 + c_2\sigma_2k_z; \\
Z; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
R_9; & c_1\sigma_0 + c_2\sigma_2k_z; \\
A; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3 + c_5(k_x^2 - k_y^2)\sigma_1; \\
R; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
U; \{R_1, R_2\}; & (c_1 + c_2k_y)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_x + c_5\sigma_3k_z; \\
\Lambda; \{R_3, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3(k_x^2 - k_y^2) + (c_6\sigma_1 + c_7\sigma_2)k_xk_y; \\
V; \{R_6, R_8\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3(k_x^2 - k_y^2) + (c_6\sigma_1 + c_7\sigma_2)k_xk_y; \\
Y; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y + c_5\sigma_3k_z; \\
W; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_2k_x; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3, R_4\}; (A_4c_3 - A_1c_5)k_x - (A_6c_3 + A_2c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_2\}, \{R_3, R_4\}; (A_6c_3 - A_2c_5)k_x + (A_4c_3 + A_1c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
V; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_2\}, \{R_6, R_8\}; (A_6c_3 - A_2c_5)k_x + (A_4c_3 + A_1c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_4\}, \{R_6, R_8\}; (A_4c_3 - A_1c_5)k_x - (A_6c_3 + A_2c_5)k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2k_x + c_2k_y) + \sigma_3 (c_3k_x + c_3k_y) + c_4\sigma_1k_z + c_5\sigma_2(k_y - k_x); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x + c_2k_y) + \sigma_3 (c_3k_x + c_3k_y) + c_4\sigma_1k_z + c_5\sigma_2(k_y - k_x); \\
T; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + c_3\sigma_3k_x + c_5\sigma_1k_y;
\end{aligned}$$

SG 119

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 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2a}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3 + c_5(k_x^2 - k_y^2)\sigma_1; \\
Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_3 + c_5(k_x^2 - k_y^2)\sigma_1; \\
\Lambda; \{R_3, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3(k_x^2 - k_y^2) + (c_6\sigma_1 + c_7\sigma_2)k_xk_y; \\
V; \{R_3, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3(k_x^2 - k_y^2) + (c_6\sigma_1 + c_7\sigma_2)k_xk_y;
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3, R_4\}; (A_4 c_3 - A_1 c_5) k_x - (A_6 c_3 + A_2 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3, R_4\}; (A_6 c_3 - A_2 c_5) k_x + (A_4 c_3 + A_1 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3, R_4\}; (A_4 c_3 - A_1 c_5) k_x - (A_6 c_3 + A_2 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3, R_4\}; (A_6 c_3 - A_2 c_5) k_x + (A_4 c_3 + A_1 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
W; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x + k_y) + c_6 \sigma_2 (k_y - k_x); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
F; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
U; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 (c_3 k_x - c_3 k_y) + c_4 \sigma_1 (k_x + k_y) + c_6 \sigma_2 k_z;
\end{aligned}$$

SG 120

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 $\Gamma_q^v; \{S_{4z}^+ | 000\}, \{C_{2a} | \frac{1}{2} 0\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_3 + c_5 (k_x^2 - k_y^2) \sigma_1; \\
N; \{R_2, R_4\}; & \quad c_1 \sigma_0 + (c_2 k_x + c_3 k_z) \sigma_3; \\
Z; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_3 + c_5 (k_x^2 - k_y^2) \sigma_1; \\
P; \{R_1, R_3\}; & \quad c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
& \{R_2, R_4\}; c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
\Lambda; \{R_3, R_4\}; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_3 (k_x^2 - k_y^2) + (c_6 \sigma_1 + c_7 \sigma_2) k_x k_y; \\
V; \{R_3, R_4\}; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_3 (k_x^2 - k_y^2) + (c_6 \sigma_1 + c_7 \sigma_2) k_x k_y; \\
Q; \{R_1, R_1\}; & \quad (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z) \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3, R_4\}; (A_4 c_3 - A_1 c_5) k_x - (A_6 c_3 + A_2 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3, R_4\}; (A_6 c_3 - A_2 c_5) k_x + (A_4 c_3 + A_1 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3, R_4\}; (A_4 c_3 - A_1 c_5) k_x - (A_6 c_3 + A_2 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3, R_4\}; (A_6 c_3 - A_2 c_5) k_x + (A_4 c_3 + A_1 c_5) k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
W; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x + k_y) + c_6 \sigma_2 (k_y - k_x); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
F; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
U; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 (c_3 k_x + c_3 k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 (c_3 k_x - c_3 k_y) + c_4 \sigma_1 (k_x + k_y) + c_6 \sigma_2 k_z;
\end{aligned}$$

SG 121

 $\Gamma_q^-; \{S_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
Z; R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
P; R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4k_z + c_5k_xk_y)\sigma_1 + c_6(k_x^2 - k_y^2)\sigma_3; \\
\Lambda; \{R_3, R_4\}; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3k_xk_y + (c_6\sigma_1 + c_7\sigma_2)(k_x^2 - k_y^2); \\
V; \{R_3, R_4\}; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3k_xk_y + (c_6\sigma_1 + c_7\sigma_2)(k_x^2 - k_y^2);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \quad \{R_1\}, \{R_3, R_4\}; [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_x - [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \quad \{R_2\}, \{R_3, R_4\}; [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_x + [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
V; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \quad \{R_1\}, \{R_3, R_4\}; [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_x - [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \quad \{R_2\}, \{R_3, R_4\}; [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_x + [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
W; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)(k_x + k_y); \\
& \quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)(k_x + k_y); \\
& \quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)(k_x - k_y); \\
& \quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)(k_x + k_y); \\
& \quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_6\sigma_2k_y + c_5\sigma_1k_z; \\
F; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_6\sigma_2k_y + c_5\sigma_1k_z; \\
Q; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_z); \\
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_2(k_y - k_x); \\
U; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_2(k_y - k_x); \\
Y; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_x - c_2k_y) + \sigma_3(c_3k_x - c_3k_y) + c_4\sigma_1(k_x + k_y);
\end{aligned}$$

SG 122

 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2x}|\frac{1}{4}\frac{3}{4}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2(k_x + k_y); \\
Z; \{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)(k_x^2 - k_y^2); \\
& \{R_7, R_8\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)(k_x^2 - k_y^2); \\
R_9; & c_1\sigma_0 + c_2\sigma_2k_z; \\
P; R_{13}; & c_1\sigma_0 + c_2(\sigma_1k_y + \sigma_2k_x); \\
& R_{14}; c_1\sigma_0 + c_2(\sigma_1k_y + \sigma_2k_x); \\
\Lambda; \{R_5, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3k_xk_y + (c_6\sigma_1 + c_7\sigma_2)(k_x^2 - k_y^2); \\
V; \{R_6, R_8\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_3k_xk_y + (c_6\sigma_1 + c_7\sigma_2)(k_x^2 - k_y^2); \\
W; R_5; & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1(k_x + k_y) + c_4\sigma_2(k_x - k_y); \\
U; \{R_1, R_2\}; & [c_1 + c_2(k_x + k_y)] \sigma_0 + (c_3\sigma_1 + c_4\sigma_2)(k_x - k_y) + c_5\sigma_3k_z; \\
Y; \{R_2, R_4\}; & [c_1 + c_2(k_x - k_y)] \sigma_0 + (c_3\sigma_1 + c_4\sigma_2)(k_x + k_y) + c_5\sigma_3k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_1\}, \{R_3, R_4\}; [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_x - [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_2\}, \{R_3, R_4\}; [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_x + [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
V; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
& \{R_2\}, \{R_6, R_8\}; [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_x + [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
& \{R_4\}, \{R_6, R_8\}; [(A_4 + A_6)c_3 + (A_2 - A_1)c_6]k_x - [(A_6 - A_4)c_3 + (A_1 + A_2)c_6]k_y + A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_6\sigma_2k_y + c_5\sigma_1k_z; \\
F; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + c_6\sigma_2k_y + c_5\sigma_1k_z; \\
Q; \{R_4\}, \{R_8\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_z); \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x + c_2k_y) + \sigma_3(c_3k_x + c_3k_y) + c_4\sigma_2(k_y - k_x);
\end{aligned}$$

SG 123

 $\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \{I|000\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
A; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
\Lambda; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
V; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2);
\end{aligned}$$



$$\begin{aligned}
Y; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
T; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

SG 124

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 $\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
& R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
M; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
& R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
Z; R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& R_{11}; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& \{R_{12}, R_{13}\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \Gamma_{0,0} + \sum_{i=1}^2 [c_{i,1} \Gamma_{i,2} k_z + c_{i,2} \Gamma_{i,0} k_x k_y + c_4 \Gamma_{i,3} (k_x^2 - k_y^2)]; \\
A; R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& R_{11}; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& \{R_{12}, R_{13}\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \Gamma_{0,0} + \sum_{i=1}^2 [c_{i,1} \Gamma_{i,2} k_z + c_{i,2} \Gamma_{i,0} k_x k_y + c_4 \Gamma_{i,3} (k_x^2 - k_y^2)]; \\
R; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& R_{10}; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
U; R_5; & (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_2 k_x + c_4 \sigma_1 k_z; \\
\Lambda; R_5; & [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3 (k_x^2 - k_y^2); \\
V; R_5; & [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3 (k_x^2 - k_y^2); \\
S; R_5; & [c_1 + c_2 (k_x + k_y)] \sigma_0 + c_3 \sigma_2 (k_x - k_y) + c_4 \sigma_1 k_z; \\
T; R_5; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_2 k_y + c_4 \sigma_1 k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
& \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
& \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
& \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
Y; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
W; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

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 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; \quad R_5; \quad & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; \quad R_9; \quad & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& R_{11}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
& R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& R_{14}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
Z; \quad R_5; \quad & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
A; \quad R_9; \quad & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& R_{11}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
& R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& R_{14}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
R; \quad R_5; \quad & c_1\sigma_0 + c_2\sigma_2k_y; \\
& R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
X; \quad R_5; \quad & c_1\sigma_0 + c_2\sigma_2k_y; \\
& R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
\Lambda; \quad R_5; \quad & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
V; \quad R_9; \quad & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_2(k_x^2 - k_y^2) + c_6\sigma_3k_xk_y; \\
Y; \quad R_5; \quad & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y + c_4\sigma_2k_z; \\
T; \quad R_5; \quad & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y + c_4\sigma_2k_z; \\
W; \quad R_5; \quad & (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1k_y + c_4\sigma_2k_x;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&U; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; c_3(A_2 k_y - A_1 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; c_3(A_2 k_x + A_1 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; c_3(A_1 k_x + A_2 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_4\}, \{R_5\}; c_3(A_1 k_y - A_2 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&V; \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_9\}; c_3[(A_1 - A_2 - A_4 - A_6)k_y - (A_1 + A_2 - A_4 + A_6)k_x] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_9\}; c_3[(-A_1 + A_2 + A_4 + A_6)k_x + (A_1 + A_2 - A_4 + A_6)k_y] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_7\}, \{R_9\}; c_3[(-A_1 + A_2 + A_4 + A_6)k_y - (A_1 + A_2 - A_4 + A_6)k_x] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_8\}, \{R_9\}; c_3[(-A_1 + A_2 + A_4 + A_6)k_x - (A_1 + A_2 - A_4 + A_6)k_y] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&S; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y);
\end{aligned}$$



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 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5(k_x^2 - k_y^2) \sigma_3; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5(k_x^2 - k_y^2) \sigma_3; \\
M; \quad R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
& \quad R_{11}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& \quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
& \quad R_{14}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
Z; \quad R_{10}; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& \quad R_{11}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& \quad \{R_{12}, R_{13}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \Gamma_{0,0} + \sum_{i=1}^2 [c_{i,1} \Gamma_{i,2} k_z + c_{i,2} \Gamma_{i,0} k_x k_y + c_4 \Gamma_{i,3} (k_x^2 - k_y^2)]; \\
A; \quad R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 (k_x^2 - k_y^2); \\
& \quad R_{11}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& \quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 (k_x^2 - k_y^2); \\
& \quad R_{14}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R; \quad R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_x; \\
& \quad R_{10}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_x; \\
X; \quad R_5; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
& \quad R_{10}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
U; \quad R_5; & \quad (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_2 k_x + c_4 \sigma_1 k_z; \\
\Lambda; \quad R_5; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3 (k_x^2 - k_y^2); \\
V; \quad R_9; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_2 (k_x^2 - k_y^2) + c_6 \sigma_3 k_x k_y; \\
S; \quad R_5; & \quad [c_1 + c_2 (k_x + k_y)] \sigma_0 + c_4 \sigma_2 (k_x - k_y) + c_3 \sigma_1 k_z; \\
Y; \quad R_5; & \quad (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 k_z; \\
W; \quad R_5; & \quad (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 k_x;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; c_3(A_2 k_y - A_1 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; c_3(A_2 k_x + A_1 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; c_3(A_1 k_x + A_2 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_4\}, \{R_5\}; c_3(A_1 k_y - A_2 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&V; \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_9\}; c_3[(A_1 - A_2 - A_4 - A_6)k_y - (A_1 + A_2 - A_4 + A_6)k_x] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_9\}; c_3[(-A_1 + A_2 + A_4 + A_6)k_x + (A_1 + A_2 - A_4 + A_6)k_y] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_7\}, \{R_9\}; c_3[(-A_1 + A_2 + A_4 + A_6)k_y - (A_1 + A_2 - A_4 + A_6)k_x] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_8\}, \{R_9\}; c_3[(-A_1 + A_2 + A_4 + A_6)k_x - (A_1 + A_2 - A_4 + A_6)k_y] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&T; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; \quad \{R_5, R_6\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad \{R_{15}, R_{16}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_{17}, R_{18}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{20}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
Z; \quad R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
A; \quad \{R_5, R_6\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad \{R_{15}, R_{16}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_{17}, R_{18}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{20}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R; \quad R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
& \quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
X; \quad R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
& \quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
\Lambda; \quad R_5; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
V; \quad \{R_5, R_6\}; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad R_{10}; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
Y; \quad \{R_2, R_4\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
& \quad \{R_6, R_8\}; \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
T; \quad \{R_2, R_4\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
& \quad \{R_6, R_8\}; \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
W; \quad R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1k_y;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\{R_1\}, \{R_5\}; & c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\{R_2\}, \{R_5\}; & c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\{R_3\}, \{R_5\}; & c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\{R_4\}, \{R_5\}; & c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&V; \{R_5, R_6\}, \{R_{10}\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + (c_2 \Gamma_{1,0} + c_2 \Gamma_{1,3} + c_3 \Gamma_{2,0} + c_3 \Gamma_{2,3}) (k_x - k_y) - \\
& & (c_3 \Gamma_{1,0} - c_3 \Gamma_{1,3} + c_2 \Gamma_{2,0} - c_2 \Gamma_{2,3}) (k_x + k_y) + [(1+i) (c_3 + i c_2) (\Gamma_{2,+} k_+ + \Gamma_{1,+} k_-) + h.c.]; \\
&\{R_5, R_6\}, \{R_7, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) (k_x^2 - k_y^2) + \\
& & (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2}) k_x k_y; \\
&\{R_7, R_8\}, \{R_{10}\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + [c_2 (\Gamma_{1,0} + \Gamma_{1,3}) - c_3 (\Gamma_{2,0} + \Gamma_{2,3})] (k_x + k_y) + \\
& & [c_2 (\Gamma_{2,0} - \Gamma_{2,3}) - c_3 (\Gamma_{1,0} - \Gamma_{1,3})] (k_x - k_y) + [(1+i) (c_2 + i c_3) (\Gamma_{2,+} k_+ - \Gamma_{1,+} k_-) + h.c.]; \\
&\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&S; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&Y; \{R_2, R_4\}, \{R_6, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_x + k_y (c_2 \Gamma_{0,1} + c_3 \Gamma_{0,2} + c_4 \Gamma_{3,1} + c_5 \Gamma_{3,2}) + k_z (c_6 \Gamma_{1,0} + c_7 \Gamma_{2,3}); \\
&T; \{R_2, R_4\}, \{R_6, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_x + k_y (c_2 \Gamma_{0,1} + c_3 \Gamma_{0,2} + c_4 \Gamma_{3,1} + c_5 \Gamma_{3,2}) + k_z (c_6 \Gamma_{1,0} + c_7 \Gamma_{2,3});
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 00 \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; \quad \{R_5, R_6\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad \{R_{15}, R_{16}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_{17}, R_{18}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{20}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
Z; \quad R_{10}; & \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
& \quad R_{11}; & \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
& \quad \{R_{12}, R_{13}\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + \sum_{i=1}^2 [c_{i,1}\Gamma_{i,2}k_z + c_{i,2}\Gamma_{i,0}k_xk_y + c_4\Gamma_{i,3}(k_x^2 - k_y^2)]; \\
A; \quad R_{10}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_2k_xk_yk_z; \\
& \quad R_{11}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_2k_xk_yk_z; \\
& \quad \{R_{12}, R_{13}\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4\Gamma_{0,2}k_z + \sum_{i=1}^2 [c_{i,2}\Gamma_{i,0}k_xk_y + c_4\Gamma_{i,3}(k_x^2 - k_y^2)]; \\
R; \quad R_5; & \quad (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_z)k_y; \\
& \quad R_{10}; & \quad (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_z)k_y; \\
X; \quad R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
& \quad R_{10}; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
U; \quad R_5; & \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z; \\
\Lambda; \quad R_5; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
V; \quad \{R_5, R_6\}; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad \{R_7, R_8\}; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad R_{10}; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
S; \quad R_5; & \quad [c_1 + c_2(k_x + k_y)] \sigma_0 + c_4\sigma_2(k_x - k_y) + c_3\sigma_1k_z; \\
Y; \quad \{R_2, R_4\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
& \quad \{R_6, R_8\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
T; \quad R_5; & \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_y; \\
W; \quad R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_2\sigma_1k_y;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_4\}, \{R_5\}; & c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_5, R_6\}, \{R_{10}\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + (c_2 \Gamma_{1,0} + c_2 \Gamma_{1,3} + c_3 \Gamma_{2,0} + c_3 \Gamma_{2,3}) (k_x - k_y) - \\
& (c_3 \Gamma_{1,0} - c_3 \Gamma_{1,3} + c_2 \Gamma_{2,0} - c_2 \Gamma_{2,3}) (k_x + k_y) + [(1+i)(c_3 + i c_2) (\Gamma_{2,+} k_+ + \Gamma_{1,+} k_-) + h.c.]; \\
\{R_5, R_6\}, \{R_7, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) (k_x^2 - k_y^2) + \\
& (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2}) k_x k_y; \\
\{R_7, R_8\}, \{R_{10}\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + [c_2 (\Gamma_{1,0} + \Gamma_{1,3}) - c_3 (\Gamma_{2,0} + \Gamma_{2,3})] (k_x + k_y) + \\
& [c_2 (\Gamma_{2,0} - \Gamma_{2,3}) - c_3 (\Gamma_{1,0} - \Gamma_{1,3})] (k_x - k_y) + [(1+i)(c_2 + i c_3) (\Gamma_{2,+} k_+ - \Gamma_{1,+} k_-) + h.c.]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
Y; \{R_2, R_4\}, \{R_6, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_x + k_y (c_2 \Gamma_{0,1} + c_3 \Gamma_{0,2} + c_4 \Gamma_{3,1} + c_5 \Gamma_{3,2}) + k_z (c_6 \Gamma_{1,0} + c_7 \Gamma_{2,3});
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
R_{10}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R_{11}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R_{12}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R_{14}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
R_{10}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
A; R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R_{11}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R_{12}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R_{14}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
\Lambda; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
V; \{R_1, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
\{R_2, R_3\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y; \\
Y; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y; \\
T; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y; \\
W; \{R_1, R_4\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_2, R_3\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_4\}, \{R_5\}; & c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_1, R_4\}, \{R_5\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 [(\Gamma_{1,0} - \Gamma_{1,3} - \Gamma_{2,0} - \Gamma_{2,3}) k_x + (-\Gamma_{1,1} + \Gamma_{1,2} + \Gamma_{2,1} - \Gamma_{2,2}) k_y] + \\
& c_3 [(\Gamma_{1,0} + \Gamma_{1,3} - \Gamma_{2,0} + \Gamma_{2,3}) k_x + (-\Gamma_{1,1} - \Gamma_{1,2} + \Gamma_{2,1} + \Gamma_{2,2}) k_y]; \\
\{R_1, R_4\}, \{R_2, R_3\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(\alpha_1 \Gamma_{0,+} + \alpha_2 \Gamma_{3,+}) k_x k_y + \alpha_3 \Gamma_{1,+} (k_x^2 - k_y^2) + h.c.] \\
\{R_2, R_3\}, \{R_5\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 [(\Gamma_{1,1} - \Gamma_{1,2} - \Gamma_{2,1} + \Gamma_{2,2}) k_x + (\Gamma_{1,0} - \Gamma_{1,3} - \Gamma_{2,0} - \Gamma_{2,3}) k_y] + \\
& c_3 [(\Gamma_{1,1} + \Gamma_{1,2} - \Gamma_{2,1} - \Gamma_{2,2}) k_x + (\Gamma_{1,0} + \Gamma_{1,3} - \Gamma_{2,0} + \Gamma_{2,3}) k_y]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
S; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
W; \{R_1, R_4\}, \{R_2, R_3\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) + k_y (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2});
\end{aligned}$$



$\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
R_{10}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R_{11}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R_{12}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R_{14}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
Z; R_{10}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
R_{11}; & c_1\sigma_0 + c_2\sigma_2k_z; \\
\{R_{12}, R_{13}\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + \sum_{i=1}^2 [c_{i,1}\Gamma_{i,2}k_z + c_{i,2}\Gamma_{i,0}k_xk_y + c_4\Gamma_{i,3}(k_x^2 - k_y^2)]; \\
A; \{R_9, R_{10}\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4\Gamma_{3,1}k_z + c_5\Gamma_{0,3}(k_x^2 - k_y^2) + \sum_{i=1}^2 c_{i,1}\Gamma_{i,3}k_xk_y; \\
\{R_{13}, R_{14}\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4\Gamma_{0,3}(k_x^2 - k_y^2) + \sum_{i=1}^2 [c_{i,1}\Gamma_{i,2}k_z + c_{i,2}\Gamma_{i,3}k_xk_y]; \\
R; \{R_9, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + c_3\Gamma_{0,2}k_z + \sum_{i=1}^2 c_{i,1}\Gamma_{i,2}k_y; \\
X; R_5; & c_1\sigma_0 + c_2\sigma_2k_y; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2k_y; \\
U; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z; \\
\Lambda; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
V; \{R_1, R_4\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
\{R_2, R_3\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y; \\
S; R_5; & [c_1 + c_2(k_x + k_y)] \sigma_0 + c_4\sigma_2(k_x - k_y) + c_3\sigma_1k_z; \\
Y; R_5; & (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y; \\
T; \{R_2, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_4, R_6\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
W; \{R_1, R_4\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
\{R_2, R_3\}; & (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & \quad c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & \quad c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & \quad c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_4\}, \{R_5\}; & \quad c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_1, R_4\}, \{R_5\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 [(\Gamma_{1,0} - \Gamma_{1,3} - \Gamma_{2,0} - \Gamma_{2,3}) k_x + (-\Gamma_{1,1} + \Gamma_{1,2} + \Gamma_{2,1} - \Gamma_{2,2}) k_y] + \\
& \quad c_3 [(\Gamma_{1,0} + \Gamma_{1,3} - \Gamma_{2,0} + \Gamma_{2,3}) k_x + (-\Gamma_{1,1} - \Gamma_{1,2} + \Gamma_{2,1} + \Gamma_{2,2}) k_y]; \\
\{R_1, R_4\}, \{R_2, R_3\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(\alpha_1 \Gamma_{0,+} + \alpha_2 \Gamma_{3,+}) k_x k_y + \alpha_3 \Gamma_{1,+} (k_x^2 - k_y^2) + h.c.] \\
\{R_2, R_3\}, \{R_5\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 [(\Gamma_{1,1} - \Gamma_{1,2} - \Gamma_{2,1} + \Gamma_{2,2}) k_x + (\Gamma_{1,0} - \Gamma_{1,3} - \Gamma_{2,0} - \Gamma_{2,3}) k_y] + \\
& \quad c_3 [(\Gamma_{1,1} + \Gamma_{1,2} - \Gamma_{2,1} - \Gamma_{2,2}) k_x + (\Gamma_{1,0} + \Gamma_{1,3} - \Gamma_{2,0} + \Gamma_{2,3}) k_y]; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
T; \{R_2, R_8\}, \{R_4, R_6\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_x + k_z (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}) + k_y (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2}); \\
W; \{R_1, R_4\}, \{R_2, R_3\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) + k_y (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2});
\end{aligned}$$

SG 131

 $\Gamma_q; \{C_{4z}^+ | 00\frac{1}{2}\}, \{C_{2x} | 000\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; \quad R_5; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
&\quad R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
&M; \quad R_5; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
&\quad R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
&Z; \quad R_9; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3(k_x^2 - k_y^2); \\
&\quad R_{11}; c_1\sigma_0 + c_2\sigma_2k_z; \\
&\quad R_{12}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3(k_x^2 - k_y^2); \\
&\quad R_{14}; c_1\sigma_0 + c_2\sigma_2k_z; \\
&A; \quad R_9; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3(k_x^2 - k_y^2); \\
&\quad R_{11}; c_1\sigma_0 + c_2\sigma_2k_z; \\
&\quad R_{12}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3(k_x^2 - k_y^2); \\
&\quad R_{14}; c_1\sigma_0 + c_2\sigma_2k_z; \\
&\Lambda; \quad R_5; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
&V; \quad R_5; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
&S; \quad R_5; \quad [c_1 + c_2(k_x + k_y)] \sigma_0 + c_4\sigma_3(k_x - k_y) + c_3\sigma_1k_z;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&U; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; c_3(A_2 k_y - A_1 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; c_3(A_2 k_x + A_1 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; c_3(A_1 k_x + A_2 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_4\}, \{R_5\}; c_3(A_1 k_y - A_2 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&V; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; c_3(A_2 k_y - A_1 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; c_3(A_2 k_x + A_1 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; c_3(A_1 k_x + A_2 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_4\}, \{R_5\}; c_3(A_1 k_y - A_2 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&Y; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

$$\begin{aligned}
T; \quad & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
W; \quad & \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
& \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

SG 132

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 $\Gamma_q; \{C_{4z}^+ | 00\frac{1}{2}\}, \{C_{2x} | 000\}, \{I | 00\frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; \quad & R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5(k_x^2 - k_y^2) \sigma_3; \\
& R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5(k_x^2 - k_y^2) \sigma_3; \\
M; \quad & R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5(k_x^2 - k_y^2) \sigma_3; \\
& R_{10}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5(k_x^2 - k_y^2) \sigma_3; \\
Z; \quad & R_9; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
& R_{11}; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& R_{12}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
& R_{14}; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
A; \quad & R_9; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
& R_{11}; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& R_{12}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
& R_{14}; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R; \quad & R_5; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& R_{10}; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
U; \quad & R_5; (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_2 k_x + c_4 \sigma_1 k_z; \\
\Lambda; \quad & R_5; [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3(k_x^2 - k_y^2); \\
V; \quad & R_5; [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3(k_x^2 - k_y^2); \\
T; \quad & R_5; (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_2 k_y + c_4 \sigma_1 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; c_3(A_2 k_y - A_1 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; c_3(A_2 k_x + A_1 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; c_3(A_1 k_x + A_2 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_4\}, \{R_5\}; c_3(A_1 k_y - A_2 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&V; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; c_3(A_2 k_y - A_1 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; c_3(A_2 k_x + A_1 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; c_3(A_1 k_x + A_2 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_4\}, \{R_5\}; c_3(A_1 k_y - A_2 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&S; \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_2\}, \{R_8\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_4\}, \{R_8\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_6\}, \{R_8\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&Y; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

$$\begin{aligned}
W; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

SG 133

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 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
R_{10}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
M; R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
R_{11}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{12}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_x k_y; \\
R_{14}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
Z; R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 (k_x^2 - k_y^2); \\
R_{11}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{12}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 (k_x^2 - k_y^2); \\
R_{14}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
A; R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{11}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
\{R_{12}, R_{13}\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \Gamma_{0,0} + \sum_{i=1}^2 [c_{i,1} \Gamma_{i,2} k_z + c_{i,2} \Gamma_{i,3} k_x k_y + c_4 \Gamma_{i,0} (k_x^2 - k_y^2)]; \\
R; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
X; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
\Lambda; R_5; & [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3 (k_x^2 - k_y^2); \\
V; R_9; & [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_2 (k_x^2 - k_y^2) + c_6 \sigma_3 k_x k_y; \\
S; R_5; & [c_1 + c_2 (k_x + k_y)] \sigma_0 + c_4 \sigma_3 (k_x - k_y) + c_3 \sigma_1 k_z; \\
Y; R_5; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 k_z; \\
T; R_5; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 k_z; \\
W; R_5; & (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&U; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; c_3(A_2 k_y - A_1 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; c_3(A_2 k_x + A_1 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; c_3(A_1 k_x + A_2 k_y) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_4\}, \{R_5\}; c_3(A_1 k_y - A_2 k_x) + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&V; \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_9\}; c_3[(A_1 - A_2 - A_4 - A_6)k_y - (A_1 + A_2 - A_4 + A_6)k_x] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_9\}; c_3[(-A_1 + A_2 + A_4 + A_6)k_x + (A_1 + A_2 - A_4 + A_6)k_y] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_7\}, \{R_9\}; c_3[(-A_1 + A_2 + A_4 + A_6)k_y - (A_1 + A_2 - A_4 + A_6)k_x] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\quad \{R_8\}, \{R_9\}; c_3[(-A_1 + A_2 + A_4 + A_6)k_x - (A_1 + A_2 - A_4 + A_6)k_y] + A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8)c_4 k_z; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y);
\end{aligned}$$



$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; \quad R_5; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
&\quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
&M; \quad R_9; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
&\quad R_{11}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
&\quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
&\quad R_{14}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
&Z; \quad R_9; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
&\quad R_{11}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
&\quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
&\quad R_{14}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
&A; \quad R_5; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
&\quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
&R; \quad R_5; \quad c_1\sigma_0 + c_2\sigma_2k_x; \\
&\quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_x; \\
&X; \quad R_5; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
&\quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
&U; \quad R_5; \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z; \\
&\Lambda; \quad R_5; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
&V; \quad R_9; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_2(k_x^2 - k_y^2) + c_6\sigma_3k_xk_y; \\
&Y; \quad R_5; \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y + c_4\sigma_2k_z; \\
&W; \quad R_5; \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1k_y + c_4\sigma_2k_x;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\quad \{R_4\}, \{R_5\}; c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&V; \{R_5\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_9\}; c_3 [(A_1 - A_2 - A_4 - A_6) k_y - (A_1 + A_2 - A_4 + A_6) k_x] + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_9\}; c_3 [(-A_1 + A_2 + A_4 + A_6) k_x + (A_1 + A_2 - A_4 + A_6) k_y] + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_7\}, \{R_9\}; c_3 [(-A_1 + A_2 + A_4 + A_6) k_y - (A_1 + A_2 - A_4 + A_6) k_x] + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\quad \{R_8\}, \{R_9\}; c_3 [(-A_1 + A_2 + A_4 + A_6) k_x - (A_1 + A_2 - A_4 + A_6) k_y] + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&S; \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&\quad \{R_2\}, \{R_8\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\quad \{R_4\}, \{R_8\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&\quad \{R_6\}, \{R_8\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
&T; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_4\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; \quad \{R_5, R_6\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad \{R_{15}, R_{16}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_{17}, R_{18}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{20}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
Z; \quad R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3(k_x^2 - k_y^2); \\
& \quad R_{11}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
& \quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3(k_x^2 - k_y^2); \\
& \quad R_{14}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
A; \quad \{R_9, R_{10}\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4\Gamma_{3,1}k_z + c_5\Gamma_{0,3}(k_x^2 - k_y^2) + \sum_{i=1}^2 c_{i,1}\Gamma_{i,3}k_xk_y; \\
& \quad \{R_{13}, R_{14}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4\Gamma_{0,3}(k_x^2 - k_y^2) + \sum_{i=1}^2 [c_{i,1}\Gamma_{i,2}k_z + c_{i,2}\Gamma_{i,3}k_xk_y]; \\
R; \quad R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
& \quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
X; \quad R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
& \quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
\Lambda; \quad R_5; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
V; \quad \{R_5, R_6\}; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad R_{10}; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
S; \quad R_5; & \quad [c_1 + c_2(k_x + k_y)] \sigma_0 + c_4\sigma_3(k_x - k_y) + c_3\sigma_1k_z; \\
Y; \quad \{R_2, R_4\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
& \quad \{R_6, R_8\}; \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
T; \quad \{R_2, R_4\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
& \quad \{R_6, R_8\}; \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
W; \quad R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_2\sigma_1k_y;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_4\}, \{R_5\}; & c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_5, R_6\}, \{R_{10}\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + (c_2 \Gamma_{1,0} + c_2 \Gamma_{1,3} + c_3 \Gamma_{2,0} + c_3 \Gamma_{2,3}) (k_x - k_y) - \\
& (c_3 \Gamma_{1,0} - c_3 \Gamma_{1,3} + c_2 \Gamma_{2,0} - c_2 \Gamma_{2,3}) (k_x + k_y) + [(1+i)(c_3 + i c_2)(\Gamma_{2,+} k_+ + \Gamma_{1,+} k_-) + h.c.]; \\
\{R_5, R_6\}, \{R_7, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) (k_x^2 - k_y^2) + \\
& (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2}) k_x k_y; \\
\{R_7, R_8\}, \{R_{10}\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + [c_2 (\Gamma_{1,0} + \Gamma_{1,3}) - c_3 (\Gamma_{2,0} + \Gamma_{2,3})] (k_x + k_y) + \\
& [c_2 (\Gamma_{2,0} - \Gamma_{2,3}) - c_3 (\Gamma_{1,0} - \Gamma_{1,3})] (k_x - k_y) + [(1+i)(c_2 + i c_3)(\Gamma_{2,+} k_+ - \Gamma_{1,+} k_-) + h.c.]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
Y; \{R_2, R_4\}, \{R_6, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_x + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) + k_y (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2}); \\
T; \{R_2, R_4\}, \{R_6, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_x + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) + k_y (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2});
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 00 \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; \quad \{R_5, R_6\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad \{R_{15}, R_{16}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_{17}, R_{18}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{20}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
Z; \quad R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{11}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
& \quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{14}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
A; \quad R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{11}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{14}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R; \quad R_5; & \quad (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_z)k_y; \\
& \quad R_{10}; \quad (c_1 + \sum_{i=x}^z c_i k_i^2) \sigma_0 + (c_2\sigma_3k_x + c_3\sigma_1k_z)k_y; \\
X; \quad R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
& \quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
U; \quad R_5; & \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z; \\
\Lambda; \quad R_5; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
V; \quad \{R_5, R_6\}; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad R_{10}; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
Y; \quad \{R_2, R_4\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
& \quad \{R_6, R_8\}; \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
T; \quad R_5; & \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_1k_y; \\
W; \quad R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1k_y;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_4\}, \{R_5\}; & c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_5, R_6\}, \{R_{10}\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + (c_2 \Gamma_{1,0} + c_2 \Gamma_{1,3} + c_3 \Gamma_{2,0} + c_3 \Gamma_{2,3}) (k_x - k_y) - \\
& (c_3 \Gamma_{1,0} - c_3 \Gamma_{1,3} + c_2 \Gamma_{2,0} - c_2 \Gamma_{2,3}) (k_x + k_y) + [(1+i)(c_3 + i c_2)(\Gamma_{2,+} k_+ + \Gamma_{1,+} k_-) + h.c.]; \\
\{R_5, R_6\}, \{R_7, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) (k_x^2 - k_y^2) + \\
& (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2}) k_x k_y; \\
\{R_7, R_8\}, \{R_{10}\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + [c_2 (\Gamma_{1,0} + \Gamma_{1,3}) - c_3 (\Gamma_{2,0} + \Gamma_{2,3})] (k_x + k_y) + \\
& [c_2 (\Gamma_{2,0} - \Gamma_{2,3}) - c_3 (\Gamma_{1,0} - \Gamma_{1,3})] (k_x - k_y) + [(1+i)(c_2 + i c_3)(\Gamma_{2,+} k_+ - \Gamma_{1,+} k_-) + h.c.]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_6\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_2\}, \{R_8\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_4\}, \{R_6\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_4\}, \{R_8\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_6\}, \{R_8\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
Y; \{R_2, R_4\}, \{R_6, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_x + k_z (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) + k_y (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2});
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; \quad R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{11}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{14}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
Z; \quad R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3(k_x^2 - k_y^2); \\
& \quad R_{11}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
& \quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3(k_x^2 - k_y^2); \\
& \quad R_{14}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
A; \quad R_{10}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_2k_xk_yk_z; \\
& \quad R_{11}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_2k_xk_yk_z; \\
& \quad \{R_{12}, R_{13}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4\Gamma_{0,2}k_z + \sum_{i=1}^2 [c_{i,2}\Gamma_{i,0}k_xk_y + c_4\Gamma_{i,3}(k_x^2 - k_y^2)]; \\
R; \quad R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
& \quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
X; \quad R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
& \quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
\Lambda; \quad R_5; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
V; \quad \{R_1, R_4\}; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad \{R_2, R_3\}; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad R_5; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y; \\
S; \quad R_5; & \quad [c_1 + c_2(k_x + k_y)] \sigma_0 + c_4\sigma_3(k_x - k_y) + c_3\sigma_1k_z; \\
Y; \quad R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_y; \\
T; \quad R_5; & \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_3k_y; \\
W; \quad \{R_1, R_4\}; & \quad (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
& \quad \{R_2, R_3\}; \quad (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_4\}, \{R_5\}; & c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_1, R_4\}, \{R_5\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 [(\Gamma_{1,0} - \Gamma_{1,3} - \Gamma_{2,0} - \Gamma_{2,3}) k_x + (-\Gamma_{1,1} + \Gamma_{1,2} + \Gamma_{2,1} - \Gamma_{2,2}) k_y] + \\
& c_3 [(\Gamma_{1,0} + \Gamma_{1,3} - \Gamma_{2,0} + \Gamma_{2,3}) k_x + (-\Gamma_{1,1} - \Gamma_{1,2} + \Gamma_{2,1} + \Gamma_{2,2}) k_y]; \\
\{R_1, R_4\}, \{R_2, R_3\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(\alpha_1 \Gamma_{0,+} + \alpha_2 \Gamma_{3,+}) k_x k_y + \alpha_3 \Gamma_{1,+} (k_x^2 - k_y^2) + h.c.] \\
\{R_2, R_3\}, \{R_5\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 [(\Gamma_{1,1} - \Gamma_{1,2} - \Gamma_{2,1} + \Gamma_{2,2}) k_x + (\Gamma_{1,0} - \Gamma_{1,3} - \Gamma_{2,0} - \Gamma_{2,3}) k_y] + \\
& c_3 [(\Gamma_{1,1} + \Gamma_{1,2} - \Gamma_{2,1} - \Gamma_{2,2}) k_x + (\Gamma_{1,0} + \Gamma_{1,3} - \Gamma_{2,0} + \Gamma_{2,3}) k_y]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
W; \{R_1, R_4\}, \{R_2, R_3\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) + k_y (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2});
\end{aligned}$$



$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
M; \quad R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{11}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{14}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
Z; \quad R_9; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{11}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
& \quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad R_{14}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
A; \quad \{R_5, R_6\}; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_7, R_8\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
& \quad \{R_{15}, R_{16}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad \{R_{17}, R_{18}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_xk_y; \\
& \quad R_{20}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_xk_y; \\
R; \quad \{R_9, R_{10}\}; & \quad c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + c_3\Gamma_{0,2}k_z + \sum_{i=1}^2 c_{i,1}\Gamma_{i,2}k_y; \\
X; \quad R_5; & \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
& \quad R_{10}; \quad c_1\sigma_0 + c_2\sigma_2k_y; \\
U; \quad R_5; & \quad (c_1 + c_2k_y)\sigma_0 + c_3\sigma_2k_x + c_4\sigma_1k_z; \\
\Lambda; \quad R_5; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
V; \quad \{R_1, R_4\}; & \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad \{R_2, R_3\}; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
& \quad R_5; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y; \\
Y; \quad R_5; & \quad (c_1 + c_2k_x)\sigma_0 + c_3\sigma_3k_y; \\
T; \quad \{R_2, R_8\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
& \quad \{R_4, R_6\}; \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
W; \quad \{R_1, R_4\}; & \quad (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
& \quad \{R_2, R_3\}; \quad (c_1 + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_4\}, \{R_5\}; & c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_1, R_4\}, \{R_5\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 [(\Gamma_{1,0} - \Gamma_{1,3} - \Gamma_{2,0} - \Gamma_{2,3}) k_x + (-\Gamma_{1,1} + \Gamma_{1,2} + \Gamma_{2,1} - \Gamma_{2,2}) k_y] + \\
& c_3 [(\Gamma_{1,0} + \Gamma_{1,3} - \Gamma_{2,0} + \Gamma_{2,3}) k_x + (-\Gamma_{1,1} - \Gamma_{1,2} + \Gamma_{2,1} + \Gamma_{2,2}) k_y]; \\
\{R_1, R_4\}, \{R_2, R_3\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(\alpha_1 \Gamma_{0,+} + \alpha_2 \Gamma_{3,+}) k_x k_y + \alpha_3 \Gamma_{1,+} (k_x^2 - k_y^2) + h.c.] \\
\{R_2, R_3\}, \{R_5\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 [(\Gamma_{1,1} - \Gamma_{1,2} - \Gamma_{2,1} + \Gamma_{2,2}) k_x + (\Gamma_{1,0} - \Gamma_{1,3} - \Gamma_{2,0} - \Gamma_{2,3}) k_y] + \\
& c_3 [(\Gamma_{1,1} + \Gamma_{1,2} - \Gamma_{2,1} - \Gamma_{2,2}) k_x + (\Gamma_{1,0} + \Gamma_{1,3} - \Gamma_{2,0} + \Gamma_{2,3}) k_y]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_6\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_2\}, \{R_8\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_4\}, \{R_6\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_4\}, \{R_8\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_6\}, \{R_8\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
T; \{R_2, R_8\}, \{R_4, R_6\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_x + k_z (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}) + k_y (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2}); \\
W; \{R_1, R_4\}, \{R_2, R_3\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + k_x (c_2 \Gamma_{1,1} + c_3 \Gamma_{1,2}) + k_y (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2});
\end{aligned}$$

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 $\Gamma_q^v; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \{I|000\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
R_{10}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
Z; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
R_{10}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
P; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (c_4k_xk_y + c_5k_z)\sigma_1 + c_6(k_x^2 - k_y^2)\sigma_3; \\
\Lambda; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
V; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2);
\end{aligned}$$

$$\begin{aligned}
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
W; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x + k_y); \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x - k_y); \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x - k_y); \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x + k_y); \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
F; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
Q; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + \sigma_1 (c_5 k_x + c_6 k_z); \\
\Delta; & \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
& \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
& \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
& \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y);
\end{aligned}$$

$$\begin{aligned}
& U; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
& \quad \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
& \quad \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
& \quad \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
& \quad \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
& \quad \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
& Y; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y); \\
& \quad \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 k_z; \\
& \quad \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 (k_x + k_y); \\
& \quad \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 (k_x + k_y); \\
& \quad \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 k_z; \\
& \quad \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y);
\end{aligned}$$

SG 140

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 $\Gamma_q^v; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
& R_{10}; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
N; R_5; & \quad c_1 \sigma_0 + (c_2 k_x + c_3 k_z) \sigma_2; \\
Z; R_5; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
& R_{10}; & \quad [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5 (k_x^2 - k_y^2) \sigma_3; \\
P; \{R_1, R_4\}; & \quad c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
& \{R_2, R_3\}; & \quad c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
& R_5; & \quad c_1 \sigma_0 + c_2 \sigma_1 k_z; \\
\Lambda; R_5; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3 (k_x^2 - k_y^2); \\
V; R_5; & \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3 (k_x^2 - k_y^2); \\
Q; \{R_1, R_2\}; & \quad (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^2 (c_{i,1} k_x + c_{i,2} k_z) \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_5\}; c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_2\}, \{R_5\}; c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_3\}, \{R_5\}; c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
& \{R_4\}, \{R_5\}; c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
W; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x + k_y); \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x - k_y); \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x - k_y); \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x + k_y); \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
F; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\Delta; & \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
& \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
& \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
& \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y);
\end{aligned}$$

$$\begin{aligned}
& U; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
& \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
& \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
& \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 c_5 \sigma_1 k_z; \\
& \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
& \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
& Y; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y); \\
& \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 (k_x + k_y); \\
& \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 (k_x + k_y); \\
& \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y);
\end{aligned}$$

SG 141

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 $\Gamma_q^v; \{C_{4z}^+ | 0\frac{1}{2}0\}, \{C_{2x} | \frac{1}{2}\frac{1}{2}0\}, \{I | \frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
 \Gamma; \quad & R_5; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
 & R_{10}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4k_xk_y\sigma_1 + c_5(k_x^2 - k_y^2)\sigma_3; \\
 X; \quad & R_5; \quad c_1\sigma_0 + c_2\sigma_2(k_x + k_y); \\
 & R_{10}; \quad c_1\sigma_0 + c_2\sigma_2(k_x + k_y); \\
 Z; \quad & R_9; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3(k_x^2 - k_y^2); \\
 & R_{11}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
 & R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3(k_x^2 - k_y^2); \\
 & R_{14}; \quad c_1\sigma_0 + c_2\sigma_2k_z; \\
 P; \quad & R_{13}; \quad c_1\sigma_0 + c_2(\sigma_2k_x + \sigma_1k_y); \\
 & R_{14}; \quad c_1\sigma_0 + c_2(\sigma_2k_x + \sigma_1k_y); \\
 \Lambda; \quad & R_5; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
 V; \quad & R_{10}; \quad [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5\sigma_1k_xk_y + c_6\sigma_3(k_x^2 - k_y^2); \\
 W; \quad & R_5; \quad (c_1 + c_2k_z)\sigma_0 + c_3\sigma_1(k_x - k_y) + c_4\sigma_3(k_x + k_y); \\
 U; \quad & R_5; \quad [c_1 + c_2(k_x + k_y)] \sigma_0 + c_3\sigma_3(k_x - k_y) + c_4\sigma_1k_z; \\
 Y; \quad & R_5; \quad [c_1 + c_2(k_x - k_y)] \sigma_0 + c_3\sigma_1(k_x + k_y) + c_4\sigma_3k_z;
 \end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_4\}, \{R_5\}; & c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_6\}, \{R_{10}\}; & c_5 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_6\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_6\}, \{R_9\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_7\}, \{R_{10}\}; & c_5 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_7\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_7\}, \{R_9\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_8\}, \{R_{10}\}; & c_5 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_8\}, \{R_9\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_9\}, \{R_{10}\}; & c_5 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
F; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
Q; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + \sigma_1 (c_5 k_x + c_6 k_z); \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y);
\end{aligned}$$

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 $\Gamma_q^v; \{C_{4z}^+ | \frac{1}{2} 00\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 000\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5(k_x^2 - k_y^2) \sigma_3; \\
R_{10}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 k_x k_y \sigma_1 + c_5(k_x^2 - k_y^2) \sigma_3; \\
N; R_5; & c_1 \sigma_0 + \sigma_2(c_2 k_z + c_3 k_x); \\
X; R_5; & c_1 \sigma_0 + c_2 \sigma_2(k_x + k_y); \\
R_{10}; & c_1 \sigma_0 + c_2 \sigma_2(k_x + k_y); \\
Z; R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3(k_x^2 - k_y^2); \\
R_{11}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{12}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3(k_x^2 - k_y^2); \\
R_{14}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
P; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + c_2(\Gamma_{3,2} k_x + \Gamma_{0,1} k_y) + c_3(\Gamma_{2,0} k_x - \Gamma_{1,3} k_y) \\
& + c_4(\Gamma_{1,0} k_x + \Gamma_{2,3} k_y) + k_z(c_4 \Gamma_{1,1} - c_6 \Gamma_{2,1}); \\
\Lambda; R_5; & [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3(k_x^2 - k_y^2); \\
V; R_{10}; & h'_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3(k_x^2 - k_y^2); \\
W; R_5; & (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_1(k_x + k_y) + c_4 \sigma_3(k_x - k_y); \\
Q; \{R_1, R_2\}; & (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^2 (c_{i,1} k_x + c_{i,2} k_z) \sigma_i; \\
U; R_5; & [c_1 + c_2(k_x + k_y)] \sigma_0 + c_3 \sigma_3(k_x - k_y) + c_4 \sigma_1 k_z; \\
Y; R_5; & [c_1 + c_2(k_x - k_y)] \sigma_0 + c_3 \sigma_1(k_x + k_y) + c_4 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & c_3 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & c_3 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & c_3 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
\{R_4\}, \{R_5\}; & c_3 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_4 k_z; \\
V; \{R_6\}, \{R_{10}\}; & c_5 (A_2 k_x + A_1 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_6\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_6\}, \{R_9\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_7\}, \{R_{10}\}; & c_5 (A_2 k_y - A_1 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_7\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_7\}, \{R_9\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_8\}, \{R_{10}\}; & c_5 (A_1 k_y - A_2 k_x) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_8\}, \{R_9\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_9\}, \{R_{10}\}; & c_5 (A_1 k_x + A_2 k_y) + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
F; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y);
\end{aligned}$$

## SG 143

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 $\Gamma_h; \{C_3^+|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned} \Gamma; \{R_2, R_3\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + [\sigma_+(\alpha_1k_zk_- + \alpha_2k_+^2) + h.c.]; \\ A; \{R_2, R_3\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + [\sigma_+(\alpha_1k_zk_- + \alpha_2k_+^2) + h.c.]; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_y - \sigma_2k_x) + c_6(\sigma_1k_x + \sigma_2k_y); \\ \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_2k_x + \sigma_1k_y) + c_6(\sigma_1k_x - \sigma_2k_y); \\ \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_y - \sigma_2k_x) + c_6(\sigma_1k_x + \sigma_2k_y); \\ P; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_y - \sigma_2k_x) + c_6(\sigma_1k_x + \sigma_2k_y); \\ \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_2k_x + \sigma_1k_y) + c_6(\sigma_1k_x - \sigma_2k_y); \\ \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_y - \sigma_2k_x) + c_6(\sigma_1k_x + \sigma_2k_y); \end{aligned}$$

## SG 144

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 $\Gamma_h; \{C_3^+|00\frac{1}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned} \Gamma; \{R_2, R_3\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + [\sigma_+(\alpha_1k_zk_- + \alpha_2k_+^2) + h.c.]; \\ A; \{R_2, R_3\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + [\sigma_+(\alpha_1k_zk_- + \alpha_2k_+^2) + h.c.]; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_y - \sigma_2k_x) + c_6(\sigma_1k_x + \sigma_2k_y); \\ \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_2k_x + \sigma_1k_y) + c_6(\sigma_1k_x - \sigma_2k_y); \\ \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_y - \sigma_2k_x) + c_6(\sigma_1k_x + \sigma_2k_y); \\ P; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_y - \sigma_2k_x) + c_6(\sigma_1k_x + \sigma_2k_y); \\ \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_2k_x + \sigma_1k_y) + c_6(\sigma_1k_x - \sigma_2k_y); \\ \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_y - \sigma_2k_x) + c_6(\sigma_1k_x + \sigma_2k_y); \end{aligned}$$

## SG 145

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 $\Gamma_h; \{C_3^+|00\frac{2}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned} \Gamma; \{R_2, R_3\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + [\sigma_+(\alpha_1k_zk_- + \alpha_2k_+^2) + h.c.]; \\ A; \{R_2, R_3\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + [\sigma_+(\alpha_1k_zk_- + \alpha_2k_+^2) + h.c.]; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_2 k_x + \sigma_1 k_y) + c_6 (\sigma_1 k_x - \sigma_2 k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_2 k_x + \sigma_1 k_y) + c_6 (\sigma_1 k_x - \sigma_2 k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y);
\end{aligned}$$

SG 146

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 $\Gamma_{rh}; \{C_3^+ | 000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; \{R_2, R_3\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_z + [\sigma_+ (\alpha_1 k_z k_- + \alpha_2 k_+^2) + h.c.]; \\
&Z; \{R_2, R_3\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_z + [\sigma_+ (\alpha_1 k_z k_- + \alpha_2 k_+^2) + h.c.];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_2 k_x + \sigma_1 k_y) + c_6 (\sigma_1 k_x - \sigma_2 k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_2 k_x + \sigma_1 k_y) + c_6 (\sigma_1 k_x - \sigma_2 k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y);
\end{aligned}$$

SG 147

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 $\Gamma_h; \{S_6^+ | 000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; \{R_2, R_6\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [\sigma_+ (\alpha_1 k_z k_- + \alpha_2 k_+^2) + h.c.]; \\
&\quad \{R_3, R_5\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [\sigma_+ (\alpha_1 k_z k_+ + \alpha_2 k_-^2) + h.c.]; \\
&A; \{R_2, R_6\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [\sigma_+ (\alpha_1 k_z k_- + \alpha_2 k_+^2) + h.c.]; \\
&\quad \{R_3, R_5\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + [\sigma_+ (\alpha_1 k_z k_+ + \alpha_2 k_-^2) + h.c.]; \\
&K; \{R_2, R_3\}; (c_1 + c_2 k_z) \sigma_0 + [\alpha_1 \sigma_+ k_- + h.c.] \\
&H; \{R_2, R_3\}; (c_1 + c_2 k_z) \sigma_0 + [\alpha_1 \sigma_+ k_- + h.c.] \\
&\Delta; \{R_2, R_3\}; (c_1 + c_2 k_z) \sigma_0 + [\alpha_1 \sigma_+ k_- + h.c.] \\
&P; \{R_2, R_3\}; (c_1 + c_2 k_z) \sigma_0 + [\alpha_1 \sigma_+ k_- + h.c.]
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2, R_3\}; [(A_4 + A_6) c_3 + A_7 c_4 + (A_2 - A_1) c_5 - A_3 c_6] k_x + [(A_1 - A_2) c_3 + A_3 c_4 + (A_4 + A_6) c_5 + A_7 c_6] k_y + \\
&\quad A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_7 k_z; \\
&P; \{R_1\}, \{R_2, R_3\}; [(A_4 + A_6) c_3 + A_7 c_4 + (A_2 - A_1) c_5 - A_3 c_6] k_x + [(A_1 - A_2) c_3 + A_3 c_4 + (A_4 + A_6) c_5 + A_7 c_6] k_y + \\
&\quad A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_7 k_z;
\end{aligned}$$

SG 148

 $\Gamma_{rh}; \{S_6^+|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + [\sigma_+(\alpha_1k_zk_- + \alpha_2k_+^2) + h.c.]; \\
\{R_3, R_5\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + [\sigma_+(\alpha_1k_zk_+ + \alpha_2k_-^2) + h.c.]; \\
Z; \{R_2, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + [\sigma_+(\alpha_1k_zk_- + \alpha_2k_+^2) + h.c.]; \\
\{R_3, R_5\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + [\sigma_+(\alpha_1k_zk_+ + \alpha_2k_-^2) + h.c.]; \\
\Lambda; \{R_2, R_3\}; & (c_1 + c_2k_z)\sigma_0 + [\alpha_1\sigma_+k_- + h.c.] \\
P; \{R_2, R_3\}; & (c_1 + c_2k_z)\sigma_0 + [\alpha_1\sigma_+k_- + h.c.]
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2, R_3\}; & [(A_4 + A_6)c_3 + A_7c_4 + (A_2 - A_1)c_5 - A_3c_6]k_x + [(A_1 - A_2)c_3 + A_3c_4 + (A_4 + A_6)c_5 + A_7c_6]k_y + \\
& A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_7k_z; \\
P; \{R_1\}, \{R_2, R_3\}; & [(A_4 + A_6)c_3 + A_7c_4 + (A_2 - A_1)c_5 - A_3c_6]k_x + [(A_1 - A_2)c_3 + A_3c_4 + (A_4 + A_6)c_5 + A_7c_6]k_y + \\
& A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_7k_z;
\end{aligned}$$

SG 149

 $\Gamma_h; \{C_3^+|000\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_3; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1k_x(2c_4k_y + c_5k_z) + \sigma_3[c_4(k_x^2 - k_y^2) + c_5k_yk_z] + c_6\sigma_2k_z; \\
A; R_3; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1k_x(2c_4k_y + c_5k_z) + \sigma_3[c_4(k_x^2 - k_y^2) + c_5k_yk_z] + c_6\sigma_2k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\left[\sigma_1\left(k_x + \frac{k_y}{\sqrt{3}}\right) + \sigma_2\left(k_y - \frac{k_x}{\sqrt{3}}\right)\right]; \\
\{R_1\}, \{R_3\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\left[(3\sigma_1 + \sqrt{3}\sigma_2)k_x + (\sqrt{3}\sigma_1 - 3\sigma_2)k_y\right]; \\
\{R_2\}, \{R_3\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\left[\sigma_1\left(k_x + \frac{k_y}{\sqrt{3}}\right) + \sigma_2\left(k_y - \frac{k_x}{\sqrt{3}}\right)\right]; \\
P; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\left[\sigma_1\left(k_x + \frac{k_y}{\sqrt{3}}\right) + \sigma_2\left(k_y - \frac{k_x}{\sqrt{3}}\right)\right]; \\
\{R_1\}, \{R_3\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\left[(3\sigma_1 + \sqrt{3}\sigma_2)k_x + (\sqrt{3}\sigma_1 - 3\sigma_2)k_y\right]; \\
\{R_2\}, \{R_3\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5\left[\sigma_1\left(k_x + \frac{k_y}{\sqrt{3}}\right) + \sigma_2\left(k_y - \frac{k_x}{\sqrt{3}}\right)\right]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + \sum_{i=1}^2 \sigma_i(c_{i,1}k_y + c_{i,2}k_z); \\
R; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + \sum_{i=1}^2 \sigma_i(c_{i,1}k_y + c_{i,2}k_z);
\end{aligned}$$

SG 150

 $\Gamma_h; \{C_3^+|000\}, \{C_{21}''|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_3; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1k_y(2c_4k_x - c_5k_z) + \sigma_3[c_4(k_x^2 - k_y^2) + c_5k_xk_z] + c_6\sigma_2k_z; \\
A; R_3; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1k_y(2c_4k_x - c_5k_z) + \sigma_3[c_4(k_x^2 - k_y^2) + c_5k_xk_z] + c_6\sigma_2k_z; \\
K; R_3; & c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_3k_y) + c_3\sigma_2k_z; \\
H; R_3; & c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_3k_y) + c_3\sigma_2k_z;
\end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 [(\sigma_1 + \sqrt{3} \sigma_2) k_x + (\sigma_2 - \sqrt{3} \sigma_1) k_y]; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 [(\sigma_1 - \sqrt{3} \sigma_2) k_x - (\sqrt{3} \sigma_1 + \sigma_2) k_y]; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 [(\sigma_1 + \sqrt{3} \sigma_2) k_x + (\sigma_2 - \sqrt{3} \sigma_1) k_y]; \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_2 k_x + \sigma_1 k_y) + c_6 (\sigma_1 k_x - \sigma_2 k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&T; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (k_x - \sqrt{3} k_y) + c_{i,2} k_z]; \\
&S; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (k_x - \sqrt{3} k_y) + c_{i,2} k_z]; \\
&T'; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\
&S'; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z);
\end{aligned}$$

## SG 151

$\Gamma_h; \{C_3^+|00\frac{1}{3}\}, \{C_{21}'|00\frac{2}{3}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned} \Gamma; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x(2c_4k_y + c_5k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5k_yk_z] + c_6\sigma_2k_z; \\ A; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x(2c_4k_y + c_5k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5k_yk_z] + c_6\sigma_2k_z; \end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\ \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5 \left[ (3\sigma_1 + \sqrt{3}\sigma_2)k_x + (\sqrt{3}\sigma_1 - 3\sigma_2)k_y \right]; \\ \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\ P; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\ \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5 \left[ (3\sigma_1 + \sqrt{3}\sigma_2)k_x + (\sqrt{3}\sigma_1 - 3\sigma_2)k_y \right]; \\ \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\ \Sigma; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + \sum_{i=1}^2 \sigma_i(c_{i,1}k_y + c_{i,2}k_z); \\ R; \{R_3\}, \{R_6\}; \sigma_0(c_1 + c_2k_x) + c_3\sigma_3k_x + \sum_{i=1}^2 \sigma_i(c_{i,1}k_y + c_{i,2}k_z); \end{aligned}$$

## SG 152

$\Gamma_h; \{C_3^+|00\frac{1}{3}\}, \{C_{21}''|00\frac{2}{3}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned} \Gamma; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_y(2c_4k_x - c_5k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5k_xk_z] + c_6\sigma_2k_z; \\ A; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_y(2c_4k_x - c_5k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5k_xk_z] + c_6\sigma_2k_z; \\ K; R_3; c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_3k_y) + c_3\sigma_2k_z; \\ H; R_3; c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_3k_y) + c_3\sigma_2k_z; \end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5 \left[ (\sigma_1 + \sqrt{3}\sigma_2)k_x + (\sigma_2 - \sqrt{3}\sigma_1)k_y \right]; \\ \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5 \left[ (\sigma_1 - \sqrt{3}\sigma_2)k_x - (\sqrt{3}\sigma_1 + \sigma_2)k_y \right]; \\ \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5 \left[ (\sigma_1 + \sqrt{3}\sigma_2)k_x + (\sigma_2 - \sqrt{3}\sigma_1)k_y \right]; \\ P; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_y - \sigma_2k_x) + c_6(\sigma_1k_x + \sigma_2k_y); \\ \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_2k_x + \sigma_1k_y) + c_6(\sigma_1k_x - \sigma_2k_y); \\ \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_y - \sigma_2k_x) + c_6(\sigma_1k_x + \sigma_2k_y); \\ T; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + \sum_{i=1}^2 \sigma_i[c_{i,1}(k_x - \sqrt{3}k_y) + c_{i,2}k_z]; \\ S; \{R_2\}, \{R_5\}; \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + \sum_{i=1}^2 \sigma_i[c_{i,1}(k_x - \sqrt{3}k_y) + c_{i,2}k_z]; \\ T'; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_z); \\ S'; \{R_3\}, \{R_6\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_z); \end{aligned}$$



SG 153

 $\Gamma_h; \{C_3^+|00\frac{2}{3}\}, \{C_{21}'|00\frac{1}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned} \Gamma; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z] + c_6 \sigma_2 k_z; \\ A; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z] + c_6 \sigma_2 k_z; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\ \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ (3\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - 3\sigma_2) k_y \right]; \\ \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\ P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\ \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ (3\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - 3\sigma_2) k_y \right]; \\ \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\ \Sigma; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\ R; \{R_2\}, \{R_5\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \end{aligned}$$

SG 154

 $\Gamma_h; \{C_3^+|00\frac{2}{3}\}, \{C_{21}''|00\frac{1}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned} \Gamma; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_y (2c_4 k_x - c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_x k_z] + c_6 \sigma_2 k_z; \\ A; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_y (2c_4 k_x - c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_x k_z] + c_6 \sigma_2 k_z; \\ K; R_3; c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_3 \sigma_2 k_z; \\ H; R_3; c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_3 \sigma_2 k_z; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ (\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sigma_2 - \sqrt{3}\sigma_1) k_y \right]; \\ \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ (\sigma_1 - \sqrt{3}\sigma_2) k_x - (\sqrt{3}\sigma_1 + \sigma_2) k_y \right]; \\ \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ (\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sigma_2 - \sqrt{3}\sigma_1) k_y \right]; \\ P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\ \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_2 k_x + \sigma_1 k_y) + c_6 (\sigma_1 k_x - \sigma_2 k_y); \\ \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\ T; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (k_x - \sqrt{3}k_y) + c_{i,2} k_z]; \\ S; \{R_3\}, \{R_6\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (k_x - \sqrt{3}k_y) + c_{i,2} k_z]; \\ T'; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\ S'; \{R_2\}, \{R_5\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \end{aligned}$$

SG 155

 $\Gamma_{rh}; \{C_3^+|000\}, \{C_{21}'|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned} \Gamma; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z] + c_6 \sigma_2 k_z; \\ Z; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z] + c_6 \sigma_2 k_z; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
&\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ (3\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - 3\sigma_2) k_y \right]; \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
&\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ (3\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - 3\sigma_2) k_y \right]; \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
&B; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\
&Q; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_x + \sqrt{3} k_y) + \sigma_1 \left[ c_2 \left( k_x - \frac{k_y}{\sqrt{3}} \right) + c_3 k_z \right] + \sigma_2 \left[ c_4 \left( \frac{k_y}{\sqrt{3}} - k_x \right) - c_5 k_z \right]; \\
&Y; \{R_1\}, \{R_2\}; \sum_{i=0,3} \sigma_i c_{i,2} (k_x - \sqrt{3} k_y) + \sigma_1 \left[ c_2 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + c_3 k_z \right] + \sigma_2 \left[ c_4 (3k_x + \sqrt{3} k_y) + 3c_5 k_z \right];
\end{aligned}$$

## SG 156

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 $\Gamma_h; \{C_3^+|000\}, \{\sigma_{v1}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sigma_1 k_y (2c_4 k_x - c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_x k_z]; \\
&A; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sigma_1 k_y (2c_4 k_x - c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_x k_z]; \\
&\Delta; R_3; (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_3 k_x - \sigma_1 k_y);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + [2A_4 c_3 + (\sqrt{3}A_8 - A_5) c_4 - 2A_1 c_6] k_x + 2(A_6 c_3 - A_7 c_4 - A_2 c_6) k_y; \\
&\{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + [2A_6 c_3 + (\sqrt{3}A_8 - A_5) c_4 - 2A_2 c_6] k_x - 2(A_4 c_3 + A_7 c_4 - A_1 c_6) k_y; \\
&U; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_x + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_y; \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_2 k_x + \sigma_1 k_y) + c_6 (\sigma_1 k_x - \sigma_2 k_y); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_x + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_y; \\
&R; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_x + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_y;
\end{aligned}$$

## SG 157

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 $\Gamma_h; \{C_3^+|000\}, \{\sigma_{d1}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z]; \\
&A; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z]; \\
&K; R_3; (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
&H; R_3; (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
&\Delta; R_3; (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
&P; R_3; (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y; \\
&\quad \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y; \\
&U; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_x; \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y; \\
&\quad \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y; \\
&T; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z] + (c_2 \sigma_1 + c_3 \sigma_2) (k_x - \sqrt{3} k_y); \\
&S; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z] + (c_2 \sigma_1 + c_3 \sigma_2) (k_x - \sqrt{3} k_y); \\
&T'; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_x; \\
&S'; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_x;
\end{aligned}$$

SG 158

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 $\Gamma_h; \{C_3^+ | 000\}, \{\sigma_{v1} | 00 \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
&\Gamma; R_3; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sigma_1 k_y (2 c_4 k_x - c_5 k_z) + \sigma_3 [c_4 (k_x^2 - k_y^2) + c_5 k_x k_z]; \\
&A; \{R_3, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&\quad \{R_6, R_6\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x + \Gamma_{0,1} k_y) + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
&L; \{R_2, R_4\}; c_1 \sigma_0 + \sigma_3 (c_2 k_x + c_3 k_z); \\
&H; \{R_1, R_1\}; c_1 \sigma_0 + \sum_{i=1}^3 c_{i,1} k_z \sigma_i; \\
&\quad \{R_2, R_2\}; c_1 \sigma_0 + \sum_{i=1}^3 c_{i,1} k_z \sigma_i; \\
&\quad \{R_3, R_3\}; c_1 \sigma_0 + \sum_{i=1}^3 c_{i,1} k_z \sigma_i; \\
&\Delta; R_3; (c_1 + c_2 k_z) \sigma_0 + c_3 (\sigma_3 k_x - \sigma_1 k_y); \\
&S; \{R_1, R_1\}; (c_1 + \sqrt{3} c_2 k_x + c_2 k_y) \sigma_0 + \sum_{i=1}^3 [c_{i,1} (k_x - \sqrt{3} k_y) + c_{i,2} k_z] \sigma_i; \\
&S'; \{R_1, R_1\}; (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z) \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + [2 A_4 c_3 + (\sqrt{3} A_8 - A_5) c_4 - 2 A_1 c_6] k_x + 2 (A_6 c_3 - A_7 c_4 - A_2 c_6) k_y; \\
&\quad \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + [2 A_6 c_3 + (\sqrt{3} A_8 - A_5) c_4 - 2 A_2 c_6] k_x - 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_y; \\
&U; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_x + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_y; \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_2 k_x + \sigma_1 k_y) + c_6 (\sigma_1 k_x - \sigma_2 k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 (\sigma_1 k_y - \sigma_2 k_x) + c_6 (\sigma_1 k_x + \sigma_2 k_y); \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_x + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_y; \\
&R; \{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_x + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_y;
\end{aligned}$$

SG 159

 $\Gamma_h; \{C_3^+|000\}, \{\sigma_{d1}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_3; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z]; \\
A; \{R_3, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_6, R_6\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,1} k_x - \Gamma_{0,3} k_y) + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
L; \{R_2, R_4\}; & c_1 \sigma_0 + \sigma_3 (c_2 k_y + c_3 k_z); \\
K; R_3; & (c_1 + c_2 k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y); \\
H; R_6; & (c_1 + c_2 k_z) \sigma_0 + c_3 (\sigma_1 k_x - \sigma_3 k_y); \\
\Delta; R_3; & (c_1 + c_2 k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y); \\
P; R_3; & (c_1 + c_2 k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y); \\
R; \{R_1, R_1\}; & (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_y + c_{i,2} k_z) \sigma_i;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y; \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_x; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y; \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y; \\
T; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i [c_{i,1} (\sqrt{3}k_x + k_y) + c_{i,2} k_z] + (c_2 \sigma_1 + c_3 \sigma_2) (k_x - \sqrt{3}k_y); \\
S; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i [c_{i,1} (\sqrt{3}k_x + k_y) + c_{i,2} k_z] + (c_2 \sigma_1 + c_3 \sigma_2) (k_x - \sqrt{3}k_y); \\
T'; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_x; \\
S'; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + (c_2 \sigma_1 + c_3 \sigma_2) k_x;
\end{aligned}$$

SG 160

 $\Gamma_{rh}; \{C_3^+|000\}, \{\sigma_{d1}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_3; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z]; \\
Z; R_3; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z]; \\
\Lambda; R_3; & (c_1 + c_2 k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y); \\
P; R_3; & (c_1 + c_2 k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y; \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y; \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y;
\end{aligned}$$

## SG 161

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 $\Gamma_{rh}; \{C_3^+|000\}, \{\sigma_{d1}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_3; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z]; \\
Z; \{R_3, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_6, R_6\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,1} k_x - \Gamma_{0,3} k_y) + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
L; \{R_2, R_4\}; & c_1 \sigma_0 + [c_2 (\sqrt{3} k_x + k_y) + c_3 k_z] \sigma_3; \\
\Lambda; R_3; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
P; R_3; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
B; \{R_1, R_1\}; & (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_y + c_{i,2} k_z) \sigma_i; \\
Y; \{R_1, R_1\}; & (c_1 + \sqrt{3} c_2 k_x - c_2 k_y) \sigma_0 + \sum_{i=1}^3 [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z] \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y; \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y; \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y;
\end{aligned}$$

## SG 162

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 $\Gamma_h; \{S_6^+|000\}, \{C'_{21}|000\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_y^2 - k_x^2) - c_5 k_y k_z]; \\
& R_6; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z]; \\
A; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_y^2 - k_x^2) - c_5 k_y k_z]; \\
& R_6; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5 k_y k_z]; \\
K; R_3; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
H; R_3; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
\Delta; R_3; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
P; R_3; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_2 c_5) k_x + [c_5 A_1 - c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_1 c_5) k_x - [c_5 A_2 + c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + c_2 \sigma_1 k_x; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_2 c_5) k_x + [c_5 A_1 - c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_1 c_5) k_x - [c_5 A_2 + c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
T; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z] + c_2 \sigma_1 (k_x - \sqrt{3} k_y); \\
S; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z] + c_2 \sigma_1 (k_x - \sqrt{3} k_y); \\
T'; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + c_2 \sigma_1 k_x; \\
S'; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + c_2 \sigma_1 k_x; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} k_x + \sigma_1 (c_2 k_y + c_3 k_z); \\
R; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} k_x + \sigma_1 (c_2 k_y + c_3 k_z);
\end{aligned}$$

SG 163

$\Gamma_h; \{S_6^+ | 000\}, \{C'_{21} | 00 \frac{1}{2}\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4 (k_y^2 - k_x^2) - c_5 k_y k_z]; \\
R_6; & [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4 (k_x^2 - k_y^2) + c_5 k_y k_z]; \\
A; \{R_7, R_8\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,1} k_y) + k_z (c_4 \Gamma_{1,2} + c_3 \Gamma_{2,2}); \\
R_9; & c_1 \sigma_0 + c_2 \sigma_1 k_z; \\
L; R_5; & c_1 \sigma_0 + \sigma_2 (c_2 k_y + c_3 k_z); \\
K; R_3; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
H; R_6; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
\Delta; R_3; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
P; R_3; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
R; \{R_2, R_4\}; & (c_1 + c_3 k_x) \sigma_0 + \sum_{i=1}^2 (c_{i,1} k_y + c_{i,2} k_z) \sigma_i;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_2 c_5) k_x + [c_5 A_1 - c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_1 c_5) k_x - [c_5 A_2 + c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + c_2 \sigma_1 k_x; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_2 c_5) k_x + [c_5 A_1 - c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_1 c_5) k_x - [c_5 A_2 + c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
T; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z] + c_2 \sigma_1 (k_x - \sqrt{3} k_y); \\
S; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z] + c_2 \sigma_1 (k_x - \sqrt{3} k_y); \\
T'; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + c_2 \sigma_1 k_x; \\
S'; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + c_2 \sigma_1 k_x; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} k_x + \sigma_1 (c_2 k_y + c_3 k_z);
\end{aligned}$$

SG 164

 $\Gamma_h; \{S_6^+|000\}, \{C_{21}''|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_y (2c_4k_x + c_5k_z) + \sigma_3 [c_4(k_y^2 - k_x^2) + c_5k_xk_z]; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_y (2c_4k_x - c_5k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5k_xk_z]; \\
A; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_y (2c_4k_x + c_5k_z) + \sigma_3 [c_4(k_y^2 - k_x^2) + c_5k_xk_z]; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_y (2c_4k_x - c_5k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5k_xk_z]; \\
K; R_3; & c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_3k_y); \\
H; R_3; & c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_3k_y); \\
\Delta; R_3; & \sigma_0(c_1 + c_2k_z) + c_3(\sigma_3k_x - \sigma_1k_y); \\
P; \{R_2, R_3\}; & \sigma_0(c_1 + c_2k_z) + \sigma_1(c_2k_x + c_3k_y) + \sigma_2(c_2k_y - c_3k_x);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0((c_3 + c_4)k_z + c_1) + \sigma_3((c_3 - c_4)k_z); \\
\{R_1\}, \{R_3\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z - 2(A_7c_3 + A_2c_5)k_y + [(\sqrt{3}A_8 - A_5)c_3 - 2A_1c_5]k_x; \\
\{R_2\}, \{R_3\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)(c_4 + c_5k_z) - 2(A_7c_3 - A_1c_6)k_y + [(\sqrt{3}A_8 - A_5)c_3 - 2A_2c_6]k_x; \\
U; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_y + c_{i,2}k_z) + c_2\sigma_1k_y; \\
P; \{R_1\}, \{R_2, R_3\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_7k_z + [(A_4 + A_6)c_3 + A_7c_4 + (A_2 - A_1)c_5 - A_3c_6]k_x + \\
& [(A_1 - A_2)c_3 + A_3c_4 + (A_4 + A_6)c_5 + A_7c_6]k_y; \\
T; \{R_1\}, \{R_2\}; & \sum_{i=0,3} \sigma_i[c_{i,1} + c_{i,2}(\sqrt{3}k_x + k_y)] + \sigma_1[c_1(k_x - \sqrt{3}k_y) + c_2k_z]; \\
S; \{R_1\}, \{R_2\}; & \sum_{i=0,3} \sigma_i[c_{i,1} + c_{i,2}(\sqrt{3}k_x + k_y)] + \sigma_1[c_1(k_x - \sqrt{3}k_y) + c_2k_z]; \\
T'; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_i c_{i,1}k_y + \sigma_1(c_2k_x + c_3k_z); \\
S'; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_i c_{i,1}k_y + \sigma_1(c_2k_x + c_3k_z); \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_y + c_{i,2}k_z) + c_2\sigma_1k_y; \\
R; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_y + c_{i,2}k_z) + c_2\sigma_1k_y;
\end{aligned}$$

SG 165

 $\Gamma_h; \{S_6^+|000\}, \{C_{21}''|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_y (2c_4k_x + c_5k_z) + \sigma_3 [c_4(k_y^2 - k_x^2) + c_5k_xk_z]; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_y (2c_4k_x - c_5k_z) + \sigma_3 [c_4(k_x^2 - k_y^2) + c_5k_xk_z]; \\
A; \{R_7, R_8\}; & c_1\Gamma_{0,0} + c_2(\Gamma_{3,1}k_x - \Gamma_{0,2}k_y) + k_z(c_4\Gamma_{1,2} + c_3\Gamma_{2,2}); \\
R_9; & c_1\sigma_0 + c_2\sigma_1k_z; \\
L; R_5; & c_1\sigma_0 + \sigma_2(c_2k_x + c_3k_z); \\
K; R_3; & c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_3k_y); \\
H; \{R_3, R_4\}; & c_1\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_z; \\
\{R_6, R_6\}; & c_1\Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}(\Gamma_{i,1}k_x - \Gamma_{i,3}k_y) + c_{i,2}k_z\Gamma_{i,2}]; \\
\Delta; R_3; & (c_1 + c_2k_z)\sigma_0 + c_3(\sigma_3k_x - \sigma_1k_y); \\
P; \{R_2, R_3\}; & (c_1 + c_2k_z)\sigma_0 + \sigma_1(c_3k_x + c_4k_y) - \sigma_2(c_4k_x - c_3k_y); \\
S; \{R_2, R_4\}; & (c_1 + \sqrt{3}c_2k_x + c_2k_y)\sigma_0 + \sum_{i=1}^2 [c_{i,1}(k_x - \sqrt{3}k_y) + c_{i,2}k_z]\sigma_i; \\
S'; \{R_2, R_4\}; & (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_z);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0((c_3 + c_4)k_z + c_1) + \sigma_3((c_3 - c_4)k_z); \\
\{R_1\}, \{R_3\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_4k_z - 2(A_7c_3 + A_2c_5)k_y + [(\sqrt{3}A_8 - A_5)c_3 - 2A_1c_5]k_x; \\
\{R_2\}, \{R_3\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)(c_4 + c_5k_z) - 2(A_7c_3 - A_1c_6)k_y + [(\sqrt{3}A_8 - A_5)c_3 - 2A_2c_6]k_x; \\
U; \{R_1\}, \{R_2\}; & \quad \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_y + c_{i,2}k_z) + c_2\sigma_1k_y; \\
P; \{R_1\}, \{R_2, R_3\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_7k_z + [(A_4 + A_6)c_3 + A_7c_4 + (A_2 - A_1)c_5 - A_3c_6]k_x + \\
& \quad [(A_1 - A_2)c_3 + A_3c_4 + (A_4 + A_6)c_5 + A_7c_6]k_y; \\
T; \{R_1\}, \{R_2\}; & \quad \sum_{i=0,3} \sigma_i[c_{i,1} + c_{i,2}(\sqrt{3}k_x + k_y)] + \sigma_1[c_1(k_x - \sqrt{3}k_y) + c_2k_z]; \\
T'; \{R_1\}, \{R_2\}; & \quad \sigma_0c_1 + \sum_{i=0,3} \sigma_i c_{i,1}k_y + \sigma_1(c_2k_x + c_3k_z); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_y + c_{i,2}k_z) + c_2\sigma_1k_y; \\
R; \{R_1\}, \{R_2\}; & \quad \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_y + c_{i,2}k_z) + c_2\sigma_1k_y;
\end{aligned}$$

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SG 166

$\Gamma_{rh}; \{S_6^+|000\}, \{C_{21}'|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2]\sigma_0 + \sigma_1k_x(2c_4k_y + c_5k_z) + \sigma_3[c_4(k_y^2 - k_x^2) - c_5k_yk_z]; \\
R_6; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2]\sigma_0 + \sigma_1k_x(2c_4k_y + c_5k_z) + \sigma_3[c_4(k_x^2 - k_y^2) + c_5k_yk_z]; \\
Z; R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2]\sigma_0 + \sigma_1k_x(2c_4k_y + c_5k_z) + \sigma_3[c_4(k_y^2 - k_x^2) - c_5k_yk_z]; \\
R_6; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2]\sigma_0 + \sigma_1k_x(2c_4k_y + c_5k_z) + \sigma_3[c_4(k_x^2 - k_y^2) + c_5k_yk_z]; \\
\Lambda; R_3; & \quad (c_1 + c_3k_z)\sigma_0 + c_2(\sigma_1k_x + \sigma_3k_y); \\
P; R_3; & \quad (c_1 + c_3k_z)\sigma_0 + c_2(\sigma_1k_x + \sigma_3k_y);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_1\}, \{R_3\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (2A_7c_4 - A_2c_5)k_x + [c_5A_1 - c_4(A_5 - \sqrt{3}A_8)]k_y; \\
\{R_2\}, \{R_3\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (2A_7c_4 - A_1c_5)k_x - [c_5A_2 + c_4(A_5 - \sqrt{3}A_8)]k_y; \\
P; \{R_1\}, \{R_2\}; & \quad \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_1\}, \{R_3\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (2A_7c_4 - A_2c_5)k_x + [c_5A_1 - c_4(A_5 - \sqrt{3}A_8)]k_y; \\
\{R_2\}, \{R_3\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (2A_7c_4 - A_1c_5)k_x - [c_5A_2 + c_4(A_5 - \sqrt{3}A_8)]k_y; \\
B; \{R_1\}, \{R_2\}; & \quad \sigma_0c_1 + \sum_{i=0,3} \sigma_i c_{i,1}k_x + \sigma_1(c_2k_y + c_3k_z); \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0c_1 + \sum_{i=0,3} \sigma_i c_{i,1}k_x + \sigma_1(c_2k_y + c_3k_z); \\
Q; \{R_1\}, \{R_2\}; & \quad \sigma_0c_1 + \sum_{i=0,3} \sigma_i c_{i,1}(k_x + \sqrt{3}k_y) + \sigma_1[c_2(\sqrt{3}k_x - k_y) + c_3k_z]; \\
Y; \{R_1\}, \{R_2\}; & \quad \sigma_0c_1 + \sum_{i=0,3} \sigma_i c_{i,1}(k_x - \sqrt{3}k_y) + \sigma_1[c_2(\sqrt{3}k_x + k_y) + c_3k_z];
\end{aligned}$$



SG 167

 $\Gamma_{rh}; \{S_6^+|000\}, \{C_{21}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4 (k_y^2 - k_x^2) - c_5 k_y k_z]; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + \sigma_1 k_x (2c_4 k_y + c_5 k_z) + \sigma_3 [c_4 (k_x^2 - k_y^2) + c_5 k_y k_z]; \\
Z; \{R_7, R_8\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,1} k_y) + k_z (c_4 \Gamma_{1,2} + c_3 \Gamma_{2,2}); \\
R_9; & c_1 \sigma_0 + c_2 \sigma_1 k_z; \\
L; R_5; & c_1 \sigma_0 + \sigma_2 [c_2 (\sqrt{3} k_x + k_y) + c_3 k_z]; \\
\Lambda; R_3; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
P; R_3; & (c_1 + c_3 k_z) \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
B; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\
Y; \{R_2, R_4\}; & (c_1 + c_2 k_x - c_2 \sqrt{3} k_y) \sigma_0 + \sum_{i=1}^2 [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z] \sigma_i;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_2 c_5) k_x + [c_5 A_1 - c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
\{R_2\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_1 c_5) k_x - [c_5 A_2 + c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_2 c_5) k_x + [c_5 A_1 - c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
\{R_2\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_1 c_5) k_x - [c_5 A_2 + c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} k_x + \sigma_1 (c_2 k_y + c_3 k_z); \\
Q; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_x + \sqrt{3} k_y) + \sigma_1 [c_2 (\sqrt{3} k_x - k_y) + c_3 k_z];
\end{aligned}$$

SG 168

 $\Gamma_h; \{C_6^+|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
\{R_3, R_5\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 \sigma_3 k_z + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
A; \{R_2, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
\{R_3, R_5\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 \sigma_3 k_z + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
K; \{R_2, R_3\}; & c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 (\sigma_1 k_y - \sigma_2 k_x) + c_4 \sigma_3 k_z; \\
H; \{R_2, R_3\}; & c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 (\sigma_1 k_y - \sigma_2 k_x) + c_4 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_1\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_1\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_1\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_2\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_2\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_2\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_3\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_3\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_4\}, \{R_5\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_4\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_5\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&U; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sigma_1 (c_1 k_x + c_2 k_y) + \sigma_2 (c_3 k_x + c_4 k_y); \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.);
\end{aligned}$$

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SG 169

 $\Gamma_h; \{C_6^+ | 00 \frac{1}{6}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; \{R_2, R_6\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_3, R_5\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_z + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&A; \{R_2, R_{12}\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&\{R_4, R_{10}\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&\{R_6, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&L; \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&K; \{R_2, R_3\}; c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 (\sigma_1 k_y - \sigma_2 k_x) + c_4 \sigma_3 k_z; \\
&H; \{R_1, R_1\}; c_1 \sigma_0 + (c_3 \sigma_1 - c_4 \sigma_2 + c_2 \sigma_3) k_z; \\
&\{R_2, R_3\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&S; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2 + c_6 \sigma_3) k_z; \\
&S'; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2 + c_6 \sigma_3) k_z; \\
&R; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2 + c_6 \sigma_3) k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_1\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_1\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_1\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_2\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_2\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_2\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_3\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_3\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_4\}, \{R_5\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_4\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_5\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&U; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sigma_1 (c_1 k_x + c_2 k_y) + \sigma_2 (c_3 k_x + c_4 k_y); \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.);
\end{aligned}$$

SG 170

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 $\Gamma_h; \{C_6^+ | 00 \frac{5}{6}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; \{R_2, R_6\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_3, R_5\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_z + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&A; \{R_2, R_{12}\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&\{R_4, R_{10}\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&\{R_6, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&L; \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&K; \{R_2, R_3\}; c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 (\sigma_1 k_y - \sigma_2 k_x) + c_4 \sigma_3 k_z; \\
&H; \{R_1, R_1\}; c_1 \sigma_0 + (c_3 \sigma_1 - c_4 \sigma_2 + c_2 \sigma_3) k_z; \\
&\{R_2, R_3\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&S; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2 + c_6 \sigma_3) k_z; \\
&S'; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2 + c_6 \sigma_3) k_z; \\
&R; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2 + c_6 \sigma_3) k_z;
\end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_1\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_1\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_1\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_2\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_2\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_2\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_3\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_3\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_4\}, \{R_5\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_4\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_5\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&U; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sigma_1 (c_1 k_x + c_2 k_y) + \sigma_2 (c_3 k_x + c_4 k_y); \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.);
\end{aligned}$$

SG 171

 $\Gamma_h; \{C_6^+ | 00\frac{1}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; \{R_2, R_6\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_3, R_5\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + (\alpha_1\sigma_+k_-^2 + h.c.); \\
A; \{R_2, R_6\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_3, R_5\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + (\alpha_1\sigma_+k_-^2 + h.c.); \\
K; \{R_2, R_3\}; c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_2k_y) + c_3(\sigma_1k_y - \sigma_2k_x) + c_4\sigma_3k_z; \\
H; \{R_2, R_3\}; c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_2k_y) + c_3(\sigma_1k_y - \sigma_2k_x) + c_4\sigma_3k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (\alpha_1k_- \sigma_+ + h.c.); \\
\{R_1\}, \{R_3\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1}k^2 + c_{i,2}k_z^2 + c_{i,3}k_z] + (\alpha_1\sigma_+k_-^2 + h.c.); \\
\{R_1\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1}k^2 + c_{i,2}k_z^2 + c_{i,3}k_z (1 + c_{i,4}k^2 + c_{i,5}k_z^2)] + [(\alpha_1k_+^3 + \alpha_2k_-^3) \sigma_+ + h.c.]; \\
\{R_1\}, \{R_5\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1}k^2 + c_{i,2}k_z^2 + c_{i,3}k_z] + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_1\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (\alpha_1k_+ \sigma_+ + h.c.); \\
\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (\alpha_1k_- \sigma_+ + h.c.); \\
\{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1}k^2 + c_{i,2}k_z^2 + c_{i,3}k_z] + (\alpha_1\sigma_+k_-^2 + h.c.); \\
\{R_2\}, \{R_5\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1}k^2 + c_{i,2}k_z^2 + c_{i,3}k_z (1 + c_{i,4}k^2 + c_{i,5}k_z^2)] + [(\alpha_1k_+^3 + \alpha_2k_-^3) \sigma_+ + h.c.]; \\
\{R_2\}, \{R_6\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1}k^2 + c_{i,2}k_z^2 + c_{i,3}k_z] + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (\alpha_1k_- \sigma_+ + h.c.); \\
\{R_3\}, \{R_5\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1}k^2 + c_{i,2}k_z^2 + c_{i,3}k_z] + (\alpha_1\sigma_+k_-^2 + h.c.); \\
\{R_3\}, \{R_6\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1}k^2 + c_{i,2}k_z^2 + c_{i,3}k_z (1 + c_{i,4}k^2 + c_{i,5}k_z^2)] + [(\alpha_1k_+^3 + \alpha_2k_-^3) \sigma_+ + h.c.]; \\
\{R_4\}, \{R_5\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (\alpha_1k_- \sigma_+ + h.c.); \\
\{R_4\}, \{R_6\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1}k^2 + c_{i,2}k_z^2 + c_{i,3}k_z] + (\alpha_1\sigma_+k_-^2 + h.c.); \\
\{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (\alpha_1k_- \sigma_+ + h.c.); \\
U; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_1k_x + c_2k_y) + \sigma_2(c_3k_x + c_4k_y); \\
P; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (\alpha_1k_- \sigma_+ + h.c.); \\
\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (\alpha_1k_+ \sigma_+ + h.c.); \\
\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (\alpha_1k_- \sigma_+ + h.c.);
\end{aligned}$$

SG 172

 $\Gamma_h; \{C_6^+ | 00\frac{2}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; \{R_2, R_6\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_3, R_5\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + (\alpha_1\sigma_+k_-^2 + h.c.); \\
A; \{R_2, R_6\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_3, R_5\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4\sigma_3k_z + (\alpha_1\sigma_+k_-^2 + h.c.); \\
K; \{R_2, R_3\}; c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_2k_y) + c_3(\sigma_1k_y - \sigma_2k_x) + c_4\sigma_3k_z; \\
H; \{R_2, R_3\}; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y) + c_3(\sigma_2k_x + \sigma_1k_y) + c_4\sigma_3k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_1\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_1\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_1\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_2\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_2\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_2\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_3\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_3\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_4\}, \{R_5\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_4\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_5\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&U; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sigma_1 (c_1 k_x + c_2 k_y) + \sigma_2 (c_3 k_x + c_4 k_y); \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.);
\end{aligned}$$

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SG 173

 $\Gamma_h; \{C_6^+ | 00 \frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; \{R_2, R_6\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_3, R_5\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 \sigma_3 k_z + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&A; \{R_2, R_{12}\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&\{R_4, R_{10}\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&\{R_6, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&L; \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&K; \{R_2, R_3\}; c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 (\sigma_1 k_y - \sigma_2 k_x) + c_4 \sigma_3 k_z; \\
&H; \{R_1, R_1\}; (c_3 \sigma_1 - c_4 \sigma_2 + c_2 \sigma_3) k_z + c_1 \sigma_0; \\
&\{R_2, R_3\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
&S; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2 + c_6 \sigma_3) k_z; \\
&S'; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2 + c_6 \sigma_3) k_z; \\
&R; \{R_1, R_1\}; (c_1 + c_2 k_x + c_3 k_y) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2 + c_6 \sigma_3) k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_1\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_1\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_1\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_2\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_2\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_2\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
&\{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_3\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_3\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
&\{R_4\}, \{R_5\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_4\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_5\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
U; &\{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sigma_1 (c_1 k_x + c_2 k_y) + \sigma_2 (c_3 k_x + c_4 k_y); \\
P; &\{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.);
\end{aligned}$$

SG 174

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 $\Gamma_h; \{S_3^+ | 000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; &\{R_2, R_6\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_3, R_5\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
A; &\{R_2, R_6\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
&\{R_3, R_5\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
\Delta; &\{R_2, R_3\}; [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + (\alpha_1 \sigma_+ k_+^2 + h.c.);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; &\{R_1\}, \{R_2, R_3\}; [\sqrt{3} A_1 (c_3 - 2c_4) + \sqrt{3} A_2 (c_4 - 2c_3) + 3(A_4 c_3 + A_6 c_4)] k_x + 3(A_1 c_3 - A_2 c_4) k_y + \\
&\quad \sqrt{3} [(2A_4 + A_6) c_4 - (A_4 + 2A_6) c_3] k_y + A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) (c_5 + c_6 k_z); \\
P; &\{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
&\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
T; &\{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 (c_{i,1} k_x + c_{i,2} k_y) + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
S; &\{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 (c_{i,1} k_x + c_{i,2} k_y) + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
T'; &\{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 (c_{i,1} k_x + c_{i,2} k_y) + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
S'; &\{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 (c_{i,1} k_x + c_{i,2} k_y) + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
\Sigma; &\{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 (c_{i,1} k_x + c_{i,2} k_y) + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
R; &\{R_1\}, \{R_2\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 (c_{i,1} k_x + c_{i,2} k_y) + (c_2 \sigma_1 + c_3 \sigma_2) k_z;
\end{aligned}$$

$\Gamma_h; \{C_3^+|000\}, \{C_2|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_3\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_8, R_9\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_{11}, R_{12}\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
A; \{R_2, R_3\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_8, R_9\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_{11}, R_{12}\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
K; \{R_2, R_6\}; & c_3(\sigma_2k_x + \sigma_1k_y) + c_2(\sigma_1k_x - \sigma_2k_y) + c_1\sigma_0; \\
\{R_3, R_5\}; & c_3(\sigma_1k_y - \sigma_2k_x) + c_2(\sigma_1k_x + \sigma_2k_y) + c_1\sigma_0; \\
H; \{R_2, R_6\}; & c_3(\sigma_2k_x + \sigma_1k_y) + c_2(\sigma_1k_x - \sigma_2k_y) + c_1\sigma_0; \\
\{R_3, R_5\}; & c_3(\sigma_1k_y - \sigma_2k_x) + c_2(\sigma_1k_x + \sigma_2k_y) + c_1\sigma_0; \\
\Delta; \{R_2, R_6\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_3, R_5\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
P; \{R_2, R_3\}; & (c_1 + c_2k_z) \sigma_0 + \sigma_1(c_3k_x + c_4k_y) - \sigma_2(c_4k_x - c_3k_y);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_1\}, \{R_2, R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)(c_5 + c_6k_z) + [(A_4 + A_6)c_3 + (A_2 - A_1)c_4]k_x + \\
& [(A_1 - A_2)c_3 + (A_4 + A_6)c_4]k_y; \\
\{R_1\}, \{R_3, R_5\}; & A_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + (\sqrt{3}A_5 + A_8)(c_6k_z + c_{10}k^2 + c_{11}k_z^2) + \\
& 2[2(A_1 - A_2)c_5 + 2A_3c_7 + (A_4 + A_6)c_8 + A_7c_9]k_xk_y + \\
& [2(A_4 + A_6)c_5 + 2A_7c_7 + (A_2 - A_1)c_8 - A_3c_9](k_x^2 - k_y^2); \\
\{R_2, R_6\}, \{R_4\}; & A_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + A_8(c_7k_z + c_{10}k^2 + c_{11}k_z^2) + \\
& 2[-2A_1c_5 + 2(A_2 - A_3)c_6 + A_4c_8 + (A_6 + A_7)c_9]k_xk_y + \\
& [2A_4c_5 + 2(A_6 + A_7)c_6 + A_1c_8 + (A_3 - A_2)c_9](k_x^2 - k_y^2); \\
\{R_2, R_6\}, \{R_3, R_5\}; & \Gamma_{1,0}(c_3k_x + c_4k_y) + \Gamma_{2,3}(c_3k_y - c_4k_x) + \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}(c_5 + c_6k_z); \\
\{R_3, R_5\}, \{R_4\}; & A_0(c_1 + c_2k_z) + A_8(c_5 + c_6k_z) + [(A_6 + A_7)c_3 + (A_3 - A_2)c_4]k_x + [(A_2 - A_3)c_3 + (A_6 + A_7)c_4]k_y; \\
U; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_5k_x + c_5k_y); \\
P; \{R_1\}, \{R_2, R_3\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_7k_z + [(A_4 + A_6)c_3 + A_7c_4 + (A_2 - A_1)c_5 - A_3c_6]k_x + \\
& [(A_1 - A_2)c_3 + A_3c_4 + (A_4 + A_6)c_5 + A_7c_6]k_y; \\
T; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_0(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_1k_z; \\
S; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_0(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_1k_z; \\
T'; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_0(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_1k_z; \\
S'; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_0(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_1k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_0(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_1k_z; \\
R; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_0(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_1k_z;
\end{aligned}$$



$\Gamma_h; \{C_3^+|000\}, \{C_2|00\frac{1}{2}\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_3\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_8, R_9\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_{11}, R_{12}\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
A; \{R_{13}, R_{15}\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4\Gamma_{3,3}k_z + (\alpha_1\Gamma_{+,1}k_-^2 + \alpha_2k_z\Gamma_{+,0}k_+ + h.c.); \\
R_{14}; & c_1\sigma_0 + c_2\sigma_3k_z; \\
L; R_5; & c_1\sigma_0 + c_2\sigma_2k_z; \\
K; \{R_2, R_6\}; & c_3(\sigma_2k_x + \sigma_1k_y) + c_2(\sigma_1k_x - \sigma_2k_y) + c_1\sigma_0; \\
\{R_3, R_5\}; & c_3(\sigma_1k_y - \sigma_2k_x) + c_2(\sigma_1k_x + \sigma_2k_y) + c_1\sigma_0; \\
H; \{R_1, R_4\}; & c_1\sigma_0 + (c_2\sigma_1 - c_3\sigma_2)k_z; \\
\{R_2, R_3\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+k_z + h.c.); \\
\{R_5, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+k_z + h.c.); \\
\Delta; \{R_2, R_6\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_3, R_5\}; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + (\alpha_1\sigma_+k_-^2 + h.c.); \\
P; \{R_2, R_3\}; & (c_1 + c_2k_z) \sigma_0 + \sigma_1(c_3k_x + c_4k_y) - \sigma_2(c_4k_x - c_3k_y); \\
S; \{R_1, R_2\}; & (c_1 + c_2k_x + c_3k_y) \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
S'; \{R_1, R_2\}; & (c_1 + c_2k_x + c_3k_y) \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
R; \{R_1, R_2\}; & (c_1 + c_2k_x + c_3k_y) \sigma_0 + (c_4\sigma_1 + c_5\sigma_2)k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_1\}, \{R_2, R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)(c_5 + c_6k_z) + [(A_4 + A_6)c_3 + (A_2 - A_1)c_4]k_x + \\
& [(A_1 - A_2)c_3 + (A_4 + A_6)c_4]k_y; \\
\{R_1\}, \{R_3, R_5\}; & A_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + (\sqrt{3}A_5 + A_8)(c_6k_z + c_{10}k^2 + c_{11}k_z^2) + \\
& 2[2(A_1 - A_2)c_5 + 2A_3c_7 + (A_4 + A_6)c_8 + A_7c_9]k_xk_y + \\
& [2(A_4 + A_6)c_5 + 2A_7c_7 + (A_2 - A_1)c_8 - A_3c_9](k_x^2 - k_y^2); \\
\{R_2, R_6\}, \{R_4\}; & A_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + A_8(c_7k_z + c_{10}k^2 + c_{11}k_z^2) + \\
& 2[-2A_1c_5 + 2(A_2 - A_3)c_6 + A_4c_8 + (A_6 + A_7)c_9]k_xk_y + \\
& [2A_4c_5 + 2(A_6 + A_7)c_6 + A_1c_8 + (A_3 - A_2)c_9](k_x^2 - k_y^2); \\
\{R_2, R_6\}, \{R_3, R_5\}; & \Gamma_{1,0}(c_3k_x + c_4k_y) + \Gamma_{2,3}(c_3k_y - c_4k_x) + \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}(c_5 + c_6k_z); \\
\{R_3, R_5\}, \{R_4\}; & A_0(c_1 + c_2k_z) + A_8(c_5 + c_6k_z) + [(A_6 + A_7)c_3 + (A_3 - A_2)c_4]k_x + [(A_2 - A_3)c_3 + (A_6 + A_7)c_4]k_y; \\
U; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + \sigma_1(c_5k_x + c_5k_y); \\
P; \{R_1\}, \{R_2, R_3\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_7k_z + [(A_4 + A_6)c_3 + A_7c_4 + (A_2 - A_1)c_5 - A_3c_6]k_x + \\
& [(A_1 - A_2)c_3 + A_3c_4 + (A_4 + A_6)c_5 + A_7c_6]k_y; \\
T; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_0(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_1k_z; \\
T'; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_0(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_1k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0c_1 + \sum_{i=0,3} \sigma_0(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_1k_z;
\end{aligned}$$

$\Gamma_h; \{C_6^+|000\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned} \Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\ & R_6; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\ A; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\ & R_6; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\ K; R_3; & c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_3 \sigma_2 k_z; \\ H; R_3; & c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_3 \sigma_2 k_z; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ & \{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ & \{R_1\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\ & \{R_1\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\ & \{R_1\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - \sigma_2) k_y]; \\ & \{R_2\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ & \{R_2\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ & \{R_2\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\ & \{R_2\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\ & \{R_3\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ & \{R_3\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ & \{R_3\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\ & \{R_4\}, \{R_5\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ & \{R_4\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ & \{R_5\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ U; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 k_x + c_3 \sigma_2 k_y; \\ P; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\ & \{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(3\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - 3\sigma_2) k_y]; \\ & \{R_2\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\ T; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3}k_x + k_y) + c_2 \sigma_2 (\sqrt{3}k_y - k_x) + c_3 \sigma_1 k_z; \\ S; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3}k_x + k_y) + c_2 \sigma_2 (\sqrt{3}k_y - k_x) + c_3 \sigma_1 k_z; \\ T'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\ S'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\ \Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\ R; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \end{aligned}$$

$\Gamma_h; \{C_6^+|00\frac{1}{6}\}, \{C_{21}^+|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\
A; R_7; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
R_8; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
R_9; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
L; R_5; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
K; R_3; & c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_3 \sigma_2 k_z; \\
H; \{R_1, R_2\}; & c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
R_3; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
S; \{R_2, R_8\}; & [c_1 + c_2 (\sqrt{3}k_x + k_y)] \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
S'; \{R_2, R_4\}; & \sigma_0 (c_2 k_y + c_1) + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
R; \{R_1, R_2\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 + c_4 \sigma_2) k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_1\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_1\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\
\{R_1\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
\{R_1\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - \sigma_2) k_y]; \\
\{R_2\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_2\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_2\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\
\{R_2\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
\{R_3\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_3\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_3\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\
\{R_4\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_4\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_5\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 k_x + c_3 \sigma_2 k_y; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\
\{R_1\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(3\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - 3\sigma_2) k_y]; \\
\{R_2\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\
T; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3}k_x + k_y) + c_2 \sigma_2 (\sqrt{3}k_y - k_x) + c_3 \sigma_1 k_z; \\
T'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z;
\end{aligned}$$

$\Gamma_h; \{C_6^+|00\frac{5}{6}\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\
A; R_7; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
R_8; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
R_9; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
L; R_5; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
K; R_3; & c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_3 \sigma_2 k_z; \\
H; \{R_1, R_2\}; & c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
R_3; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
S; \{R_2, R_8\}; & [c_1 + c_2 (\sqrt{3}k_x + k_y)] \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
S'; \{R_2, R_4\}; & \sigma_0 (c_2 k_y + c_1) + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
R; \{R_1, R_2\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 + c_4 \sigma_2) k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_1\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_1\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\
\{R_1\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
\{R_1\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - \sigma_2) k_y]; \\
\{R_2\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_2\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_2\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\
\{R_2\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
\{R_3\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_3\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_3\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\
\{R_4\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_4\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_5\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
U; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 k_x + c_3 \sigma_2 k_y; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\
\{R_1\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(3\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - 3\sigma_2) k_y]; \\
\{R_2\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\
T; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3}k_x + k_y) + c_2 \sigma_2 (\sqrt{3}k_y - k_x) + c_3 \sigma_1 k_z; \\
T'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z;
\end{aligned}$$

$\Gamma_h$ ;  $\{C_6^+|00\frac{1}{3}\}, \{C_{21}^+|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$$\begin{aligned} \Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\ R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\ A; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\ R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\ K; R_3; & c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_3 \sigma_2 k_z; \\ H; R_3; & c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_3 \sigma_2 k_z; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ \{R_1\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ \{R_1\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\ \{R_1\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\ \{R_1\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - \sigma_2) k_y]; \\ \{R_2\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ \{R_2\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ \{R_2\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\ \{R_2\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\ \{R_3\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ \{R_3\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ \{R_3\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\ \{R_4\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ \{R_4\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ \{R_5\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ U; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 k_x + c_3 \sigma_2 k_y; \\ P; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\ \{R_1\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(3\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - 3\sigma_2) k_y]; \\ \{R_2\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\ T; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3}k_x + k_y) + c_2 \sigma_2 (\sqrt{3}k_y - k_x) + c_3 \sigma_1 k_z; \\ S; \{R_2\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3}k_x + k_y) + c_2 \sigma_2 (\sqrt{3}k_y - k_x) + c_3 \sigma_1 k_z; \\ T'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\ S'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\ \Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\ R; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \end{aligned}$$

SG 181

 $\Gamma_h; \{C_6^+|00\frac{2}{3}\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\Gamma; R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z;$$

$$R_6; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z;$$

$$A; R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z;$$

$$R_6; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z;$$

$$K; R_3; c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_3 \sigma_2 k_z;$$

$$H; R_3; c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_3 \sigma_2 k_z;$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ \{R_1\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ \{R_1\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\ \{R_1\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\ \{R_1\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - \sigma_2) k_y]; \\ \{R_2\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ \{R_2\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ \{R_2\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\ \{R_2\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\ \{R_3\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ \{R_3\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ \{R_3\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\ \{R_4\}, \{R_5\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ \{R_4\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\ \{R_5\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\ U; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 k_x + c_3 \sigma_2 k_y; \\ P; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\ \{R_1\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(3\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - 3\sigma_2) k_y]; \\ \{R_2\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\ T; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3}k_x + k_y) + c_2 \sigma_2 (\sqrt{3}k_y - k_x) + c_3 \sigma_1 k_z; \\ S; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3}k_x + k_y) + c_2 \sigma_2 (\sqrt{3}k_y - k_x) + c_3 \sigma_1 k_z; \\ T'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\ S'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\ \Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \\ R; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z; \end{aligned}$$

$\Gamma_h; \{C_6^+|00\frac{1}{2}\}, \{C_{21}^+|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\
R_6; & \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)] + c_5 \sigma_2 k_z; \\
A; R_7; & \quad c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
R_8; & \quad c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
R_9; & \quad c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
L; R_5; & \quad c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
K; R_3; & \quad c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_3 \sigma_2 k_z; \\
H; \{R_1, R_2\}; & \quad c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
R_3; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
S; \{R_2, R_8\}; & \quad [c_1 + c_2 (\sqrt{3}k_x + k_y)] \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
S'; \{R_2, R_4\}; & \quad \sigma_0 (c_2 k_y + c_1) + (c_3 \sigma_1 + c_4 \sigma_2) k_z; \\
R; \{R_1, R_2\}; & \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 + c_4 \sigma_2) k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\
\{R_1\}, \{R_5\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
\{R_1\}, \{R_6\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - \sigma_2) k_y]; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_2\}, \{R_5\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\
\{R_2\}, \{R_6\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_3\}, \{R_5\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_3\}, \{R_6\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z (1 + c_{i,4} k^2 + c_{i,5} k_z^2)] + [(c_2 k_+^3 + c_2 k_-^3) \sigma_+ + h.c.]; \\
\{R_4\}, \{R_5\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
\{R_4\}, \{R_6\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 [c_{i,1} k^2 + c_{i,2} k_z^2 + c_{i,3} k_z] + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_5\}, \{R_6\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(\sigma_1 - \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 + \sigma_2) k_y]; \\
U; \{R_1\}, \{R_2\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 k_x + c_3 \sigma_2 k_y; \\
P; \{R_1\}, \{R_2\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 [(3\sigma_1 + \sqrt{3}\sigma_2) k_x + (\sqrt{3}\sigma_1 - 3\sigma_2) k_y]; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_0 c_{i,1} k_z + c_2 \sigma_1 \left(k_x + \frac{k_y}{\sqrt{3}}\right) + c_2 \sigma_2 \left(k_y - \frac{k_x}{\sqrt{3}}\right); \\
T; \{R_1\}, \{R_2\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3}k_x + k_y) + c_2 \sigma_2 (\sqrt{3}k_y - k_x) + c_3 \sigma_1 k_z; \\
T'; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x + c_6 \sigma_2 k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_6 \sigma_2 k_y + c_5 \sigma_1 k_z;
\end{aligned}$$

$\Gamma_h$ ;  $\{C_6^+|000\}, \{\sigma_v|000\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1k_xk_y - \sigma_3(k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1k_xk_y + \sigma_3(k_x^2 - k_y^2)]; \\
A; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1k_xk_y - \sigma_3(k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1k_xk_y + \sigma_3(k_x^2 - k_y^2)]; \\
K; R_3; & c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_3k_y); \\
H; R_3; & c_1\sigma_0 + c_2(\sigma_1k_x + \sigma_3k_y); \\
\Delta; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5 [2\sigma_1k_xk_y - \sigma_3(k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5 [2\sigma_1k_xk_y + \sigma_3(k_x^2 - k_y^2)]; \\
P; R_3; & \sigma_0(c_1 + c_2k_z) + c_3(\sigma_1k_x + \sigma_3k_y);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_1\}, \{R_5\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z; \\
\{R_1\}, \{R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + c_4(A_1k_x + A_2k_y) + c_6(A_4k_x + A_6k_y); \\
\{R_2\}, \{R_3\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_2\}, \{R_5\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z; \\
\{R_2\}, \{R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_6c_5 - A_2c_6)k_x + (A_1c_6 - A_4c_5)k_y; \\
\{R_3\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_3\}, \{R_5\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_4c_5 - A_1c_6)k_x + (A_2c_6 - A_6c_5)k_y; \\
\{R_3\}, \{R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z; \\
\{R_4\}, \{R_5\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + c_4(A_2k_x + A_1k_y) + c_6(A_6k_x + A_4k_y); \\
\{R_4\}, \{R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z; \\
\{R_5\}, \{R_6\}; & c_1\Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0}c_{i,1}k_z + c_2(\Gamma_{1,2}k_y - \Gamma_{2,0}k_x) + c_3(\Gamma_{1,0}k_x + \Gamma_{2,2}k_y); \\
U; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
\{R_1\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
\{R_2\}, \{R_3\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_y; \\
\{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + (c_5\sigma_1 + c_6\sigma_2)k_x; \\
\{R_3\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
P; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z; \\
\{R_1\}, \{R_3\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z + 2(A_6c_3 + A_7c_4 - A_2c_6)k_x + [(\sqrt{3}A_8 - A_5)c_4 + 2(A_1c_6 - A_4c_3)]k_y; \\
\{R_2\}, \{R_3\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_5k_z + 2(A_4c_3 + A_7c_4 - A_1c_6)k_x + [(\sqrt{3}A_8 - A_5)c_4 + 2(A_6c_3 - A_2c_6)]k_y; \\
T; \{R_1\}, \{R_2\}; & \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + c_5\sigma_2(k_x - \sqrt{3}k_y); \\
S; \{R_1\}, \{R_2\}; & \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + c_5\sigma_2(k_x - \sqrt{3}k_y); \\
T'; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
S'; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_1k_x; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_2k_y; \\
R; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5\sigma_2k_y;
\end{aligned}$$



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 $\Gamma_h; \{C_6^+|000\}, \{\sigma_{v1}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
A; \{R_3, R_4\}; & c_1\sigma_0 + c_2\sigma_3 k_z; \\
\{R_6, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}\Gamma_{i,0}k_z + c_{i,2}\Gamma_{i,3} (k_x^2 - k_y^2) - 2c_{i,2}\Gamma_{i,1}k_x k_y]; \\
\{R_9, R_{10}\}; & c_1\sigma_0 + c_2\sigma_3 k_z; \\
\{R_{12}, R_{12}\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}\Gamma_{i,0}k_z + c_{i,2}\Gamma_{i,3} (k_x^2 - k_y^2) - 2c_{i,2}\Gamma_{i,1}k_x k_y]; \\
L; \{R_2, R_4\}; & c_1\sigma_0 + c_2\sigma_3 k_z; \\
\{R_6, R_8\}; & c_1\sigma_0 + c_2\sigma_3 k_z; \\
K; R_3; & c_1\sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
H; \{R_3, R_4\}; & c_1\sigma_0 + c_2\sigma_3 k_z; \\
\{R_6, R_6\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}\Gamma_{i,0}k_z + c_{i,2} (\Gamma_{i,1}k_x - \Gamma_{i,3}k_y)]; \\
\Delta; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
P; R_3; & (c_1 + c_2k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y); \\
S; \{R_1, R_2\}; & [c_1 + c_2 (\sqrt{3}k_x + k_y)] \sigma_0 + (c_3\sigma_1 + c_4\sigma_2) (k_x - \sqrt{3}k_y) + c_5\sigma_3 k_z; \\
S'; \{R_1, R_2\}; & (c_1 + c_2k_y) \sigma_0 + (c_2\sigma_1 + c_4\sigma_2) k_x + c_5\sigma_3 k_z; \\
R; \{R_1, R_2\}; & (c_1 + c_2k_x) \sigma_0 + (c_2\sigma_1 + c_4\sigma_2) k_y + c_5\sigma_3 k_z;
\end{aligned}$$

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_1\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y) + c_6 (A_4 k_x + A_6 k_y); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_2\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (A_6 c_5 - A_2 c_6) k_x + (A_1 c_6 - A_4 c_5) k_y; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (A_4 c_5 - A_1 c_6) k_x + (A_2 c_6 - A_6 c_5) k_y; \\
\{R_3\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_4\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_2 k_x + A_1 k_y) + c_6 (A_6 k_x + A_4 k_y); \\
\{R_4\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_5\}, \{R_6\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 (\Gamma_{1,2} k_y - \Gamma_{2,0} k_x) + c_3 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y; \\
\{R_2\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y; \\
T; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_2 (k_x - \sqrt{3} k_y); \\
T'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_2 k_y;
\end{aligned}$$

$\Gamma_h; \{C_6^+|00\frac{1}{2}\}, \{\sigma_{v1}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
A; \{R_4, R_{10}\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_5, R_{11}\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_6, R_{12}\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4 \Gamma_{3,0} k_z + c_5 [2\Gamma_{0,1} k_x k_y + \Gamma_{0,3} (k_x^2 - k_y^2)] + [\alpha_1 k_z (k_x \Gamma_{+,1} + k_y \Gamma_{+,3}) + h.c.]; \\
L; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_6, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
K; R_3; & c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
H; \{R_1, R_1\}; & c_1 \sigma_0 + (c_3 \sigma_1 - c_4 \sigma_2 + c_2 \sigma_3) k_z; \\
& \{R_2, R_2\}; c_1 \sigma_0 + (c_3 \sigma_1 - c_4 \sigma_2 + c_2 \sigma_3) k_z; \\
& \{R_3, R_3\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,1} k_x + \Gamma_{0,3} k_y) + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
\Delta; R_5; & [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
P; R_3; & \sigma_0 (c_1 + c_2 k_z) + c_3 (\sigma_1 k_x + \sigma_3 k_y); \\
S; \{R_1, R_1\}; & [c_1 + c_2 (\sqrt{3} k_x + k_y)] \sigma_0 + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
& \{R_2, R_2\}; [c_1 + c_2 (\sqrt{3} k_x + k_y)] \sigma_0 + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
S'; \{R_1, R_1\}; & (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
& \{R_2, R_2\}; (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
R; \{R_1, R_2\}; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_3 k_z;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$\{R_1\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$\{R_1\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$\{R_1\}, \{R_5\}$ ;	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z$ ;
$\{R_1\}, \{R_6\}$ ;	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y) + c_6 (A_4 k_x + A_6 k_y)$ ;
$\{R_2\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$\{R_2\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$\{R_2\}, \{R_5\}$ ;	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z$ ;
$\{R_2\}, \{R_6\}$ ;	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + (A_6 c_5 - A_2 c_6) k_x + (A_1 c_6 - A_4 c_5) k_y$ ;
$\{R_3\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$\{R_3\}, \{R_5\}$ ;	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + (A_4 c_5 - A_1 c_6) k_x + (A_2 c_6 - A_6 c_5) k_y$ ;
$\{R_3\}, \{R_6\}$ ;	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z$ ;
$\{R_4\}, \{R_5\}$ ;	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_2 k_x + A_1 k_y) + c_6 (A_6 k_x + A_4 k_y)$ ;
$\{R_4\}, \{R_6\}$ ;	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z$ ;
$\{R_5\}, \{R_6\}$ ;	$c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 (\Gamma_{1,2} k_y - \Gamma_{2,0} k_x) + c_3 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y)$ ;
$U$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$\{R_1\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x$ ;
$\{R_1\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y$ ;
$\{R_2\}, \{R_3\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y$ ;
$\{R_2\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x$ ;
$\{R_3\}, \{R_4\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$P$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z$ ;
$\{R_1\}, \{R_3\}$ ;	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y$ ;
$\{R_2\}, \{R_3\}$ ;	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y$ ;
$T$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_2 (k_x - \sqrt{3}k_y)$ ;
$S$ ; $\{R_1, R_1\}, \{R_2, R_2\}$ ;	$c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} (\sqrt{3}k_x + k_y) + [(\alpha_1 \Gamma_{1,+} + c_2 \Gamma_{1,3} + c_3 \Gamma_{2,0}) (k_x - \sqrt{3}k_y) + (\alpha_2 \Gamma_{0,+} + \alpha_3 \Gamma_{3,+} + c_4 \Gamma_{0,3} + c_5 \Gamma_{3,3}) k_z + h.c.]$ ;
$T'$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x$ ;
$S'$ ; $\{R_1, R_1\}, \{R_2, R_2\}$ ;	$c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_y + [(\alpha_1 \Gamma_{2,+} + c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}) k_x + (\alpha_2 \Gamma_{0,+} + \alpha_3 \Gamma_{3,+} + c_4 \Gamma_{0,3} + c_5 \Gamma_{3,3}) k_z + h.c.]$ ;
$\Sigma$ ; $\{R_1\}, \{R_2\}$ ;	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_2 k_y$ ;

SG 186

 $\Gamma_h; \{C_6^+|00\frac{1}{2}\}, \{\sigma_{v1}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)] ; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)] ; \\
A; \{R_4, R_{10}\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_5, R_{11}\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_6, R_{12}\}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4 \Gamma_{3,0} k_z + c_5 [2\Gamma_{0,1} k_x k_y + \Gamma_{0,3} (k_x^2 - k_y^2)] + [\alpha_1 k_z (k_x \Gamma_{+,3} - k_y \Gamma_{+,1}) + h.c.] ; \\
L; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& \{R_6, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
K; R_3; & c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y) ; \\
H; \{R_3, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z; \\
& R_6; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_3 (\sigma_1 k_x k_z - \sigma_3 k_y k_z) ; \\
\Delta; R_5; & [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)] ; \\
& R_6; [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)] ; \\
P; R_3; & \sigma_0 (c_1 + c_2 k_z) + c_3 (\sigma_1 k_x + \sigma_3 k_y) ; \\
S; \{R_1, R_2\}; & [c_1 + c_2 (\sqrt{3} k_x + k_y)] \sigma_0 + c_3 \sigma_3 k_z; \\
S'; \{R_1, R_2\}; & (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_3 k_z; \\
R; \{R_1, R_1\}; & (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
& \{R_2, R_2\}; (c_1 + c_2 k_x) \sigma_0 + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$\Delta; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_5\};$	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z;$
$\{R_1\}, \{R_6\};$	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y) + c_6 (A_4 k_x + A_6 k_y);$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_2\}, \{R_5\};$	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z;$
$\{R_2\}, \{R_6\};$	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + (A_6 c_5 - A_2 c_6) k_x + (A_1 c_6 - A_4 c_5) k_y;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_3\}, \{R_5\};$	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + (A_4 c_5 - A_1 c_6) k_x + (A_2 c_6 - A_6 c_5) k_y;$
$\{R_3\}, \{R_6\};$	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z;$
$\{R_4\}, \{R_5\};$	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_2 k_x + A_1 k_y) + c_6 (A_6 k_x + A_4 k_y);$
$\{R_4\}, \{R_6\};$	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z;$
$\{R_5\}, \{R_6\};$	$c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 (\Gamma_{1,2} k_y - \Gamma_{2,0} k_x) + c_3 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y);$
$U; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_1\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_3\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_y;$
$\{R_2\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) k_x;$
$\{R_3\}, \{R_4\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$P; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;$
$\{R_1\}, \{R_3\};$	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y;$
$\{R_2\}, \{R_3\};$	$A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3}A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y;$
$T; \{R_1\}, \{R_2\};$	$\sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_2 (k_x - \sqrt{3}k_y);$
$T'; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x;$
$\Sigma; \{R_1\}, \{R_2\};$	$\sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_2 k_y;$
$R; \{R_1, R_1\}, \{R_2, R_2\};$	$\sum_{i=0,3} \Gamma_{i,0} (c_{i,1} + c_{i,2} k_x) + [k_y (\alpha_1 \Gamma_{1,+} + c_1 \Gamma_{1,3} + c_2 \Gamma_{2,0}) + k_z (\alpha_2 \Gamma_{0,+} + \alpha_3 \Gamma_{3,+} + c_3 \Gamma_{0,3} + c_4 \Gamma_{3,3}) + h.c.];$

SG 187

 $\Gamma_h; \{S_3^+ | 000\}, \{C'_{21} | 000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$\Gamma; R_5; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)];$
$R_6; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)];$
$A; R_5; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)];$
$R_6; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)];$
$\Delta; R_3; [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)];$

$$\begin{aligned}
& \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\Delta; & \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y); \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_1 k_y - A_2 k_x); \\
U; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_2 k_y; \\
P; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x - \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( \frac{k_x}{\sqrt{3}} + k_y \right) \right]; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ (\sqrt{3}\sigma_2 - 3\sigma_1) k_x + (\sqrt{3}\sigma_1 + 3\sigma_2) k_y \right]; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x - \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( \frac{k_x}{\sqrt{3}} + k_y \right) \right]; \\
T; & \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_2 k_z; \\
S; & \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_2 k_z; \\
T'; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_2 k_z; \\
S'; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_2 k_z; \\
\Sigma; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
R; & \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_y; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

SG 188

 $\Gamma_h; \{S_3^+ | 000\}, \{C'_{21} | 00 \frac{1}{2}\}, \mathcal{T}$ ; Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; & R_5; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
& R_6; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
A; & \{R_7, R_8\}; [c_1 + c_2 (k_x^2 + k_y^2) + c_3 k_z^2] \Gamma_{0,0} + c_4 (\Gamma_{0,1} k_x - \Gamma_{3,2} k_y) k_z + [2\alpha_1 k_x k_y \Gamma_{+,0} + i\alpha_1 \Gamma_{+,3} (k_x^2 - k_y^2) + \alpha_2 k_z \Gamma_{+,2} + h.c.]; \\
& R_9; c_1 \sigma_0 + c_2 \sigma_1 k_z; \\
L; & R_5; c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
H; & \{R_1, R_4\}; c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
& \{R_2, R_5\}; c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
& \{R_3, R_6\}; c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_z; \\
\Delta; & R_3; [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
S; & \{R_1, R_2\}; [c_1 + c_2 (\sqrt{3}k_x + k_y)] \sigma_0 + c_3 \sigma_3 (k_x - \sqrt{3}k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 k_z; \\
S'; & \{R_1, R_2\}; (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_3 k_x + (c_4 \sigma_1 + c_5 \sigma_2) k_z; \\
R; & R_5; (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_3 k_y + c_4 \sigma_1 k_z;
\end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y); \\
&\quad \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_1 k_y - A_2 k_x); \\
&U; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_2 k_y; \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x - \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( \frac{k_x}{\sqrt{3}} + k_y \right) \right]; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ (\sqrt{3}\sigma_2 - 3\sigma_1) k_x + (\sqrt{3}\sigma_1 + 3\sigma_2) k_y \right]; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \left[ \sigma_1 \left( k_x - \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( \frac{k_x}{\sqrt{3}} + k_y \right) \right]; \\
&T; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_2 k_z; \\
&T'; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_2 k_z; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

SG 189

 $\Gamma_h; \{S_3^+ | 000\}, \{C_{21}'' | 000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&\quad R_6; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
&A; R_5; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&\quad R_6; [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
&K; R_5; c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
&\quad R_6; c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
&H; R_5; c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
&\quad R_6; c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
&\Delta; R_3; [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&P; R_3; (c_1 + c_2 k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y);
\end{aligned}$$



$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_1 k_y - A_2 k_x); \\
&\quad \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y); \\
&U; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_2 k_x; \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y; \\
&\quad \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y; \\
&T; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) (k_x - \sqrt{3} k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) (k_x - \sqrt{3} k_y); \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
&S; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) (k_x - \sqrt{3} k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) (k_x - \sqrt{3} k_y); \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
&T'; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&S'; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_z; \\
&R; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_z;
\end{aligned}$$

$\Gamma_h; \{S_3^+ | 000\}, \{C_{21}'' | 00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
A; \{R_7, R_8\}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4 (\Gamma_{0,1} k_y + \Gamma_{3,2} k_x) k_z + [2\alpha_1 k_x k_y \Gamma_{+,0} + i\alpha_1 \Gamma_{+,3} (k_x^2 - k_y^2) + \alpha_2 k_z \Gamma_{+,2} + h.c.]; \\
R_9; & c_1 \sigma_0 + c_2 \sigma_1 k_z; \\
L; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
K; R_5; & c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
R_6; & c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
H; R_7; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 (\sigma_2 k_x + \sigma_1 k_y) k_z; \\
R_8; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 (\sigma_2 k_x - \sigma_1 k_y) k_z; \\
R_9; & c_1 \sigma_0 + c_2 \sigma_1 k_z; \\
\Delta; R_3; & [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
P; R_3; & (c_1 + c_2 k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y); \\
S; R_5; & [c_1 + c_2 (\sqrt{3} k_x + k_y)] \sigma_0 + c_3 \sigma_3 (k_x - \sqrt{3} k_y) + c_4 \sigma_1 k_z; \\
S'; R_5; & (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
R; \{R_1, R_2\}; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_3 k_y + (c_4 \sigma_1 + c_5 \sigma_2) k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_1 k_y - A_2 k_x); \\
\{R_2\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y); \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_2 k_x; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_6 c_3 + A_7 c_4 - A_2 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_1 c_6 - A_4 c_3)] k_y; \\
\{R_2\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_5 k_z + 2 (A_4 c_3 + A_7 c_4 - A_1 c_6) k_x + [(\sqrt{3} A_8 - A_5) c_4 + 2 (A_6 c_3 - A_2 c_6)] k_y; \\
T; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) (k_x - \sqrt{3} k_y); \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) (k_x - \sqrt{3} k_y); \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + (c_5 \sigma_1 - c_6 \sigma_2) k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
T'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + (c_4 \sigma_1 - c_5 \sigma_2) k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_z;
\end{aligned}$$

SG 191

 $\Gamma_h; \{C_3^+|000\}, \{C_{21}'|000\}, \{C_2|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&R_6; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&R_9; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&R_{12}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&A; R_3; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&R_6; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&R_9; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&R_{12}; [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&K; R_5; c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
&R_6; c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
&H; R_5; c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
&R_6; c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
&\Delta; R_5; [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
&R_6; [c_1 + c_2 k_z + c_3(k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&P; R_3; (c_1 + c_2 k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y);
\end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z; \\
&\quad \{R_1\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z; \\
&\quad \{R_2\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_1 k_y - A_2 k_x); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_2 k_y - A_1 k_x); \\
&\quad \{R_3\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z; \\
&\quad \{R_4\}, \{R_5\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_2 k_x + A_1 k_y); \\
&\quad \{R_4\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z; \\
&\quad \{R_5\}, \{R_6\}; c_1 \Gamma_{0,0} + k_z \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
&U; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_2 c_5) k_x + [c_5 A_1 - c_4 (A_5 - \sqrt{3}A_8)] k_y; \\
&\quad \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_1 c_5) k_x - [c_5 A_2 + c_4 (A_5 - \sqrt{3}A_8)] k_y; \\
&T; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_1 (k_x - \sqrt{3}k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_1 (k_x - \sqrt{3}k_y); \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y); \\
&S; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_1 (k_x - \sqrt{3}k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_1 (k_x - \sqrt{3}k_y); \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3}k_x + k_y)] + \sigma_3 c_3 (\sqrt{3}k_x + k_y); \\
&T'; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&S'; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y;
\end{aligned}$$

$$\begin{aligned}
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&R; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

SG 192

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 $\Gamma_h; \{C_3^+|000\}, \{C_{21}'|00\frac{1}{2}\}, \{C_2|000\}, \{I|000\}, \mathcal{T}; \text{Centrosymmetric; without SOC}$ 

$$\begin{aligned}
&\Gamma; R_3; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&\quad R_6; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&\quad R_9; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&\quad R_{12}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&A; \{R_7, R_8\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \Gamma_{0,0} + [2\alpha_1 k_x k_y \Gamma_{+,0} + i\alpha_1 \Gamma_{+,3} (k_x^2 - k_y^2) + \alpha_2 k_z \Gamma_{+,2} + h.c.]; \\
&\quad R_9; \quad c_1 \sigma_0 + c_2 \sigma_1 k_z; \\
&\quad \{R_{16}, R_{17}\}; \quad [c_1 + c_2(k_x^2 + k_y^2) + c_3 k_z^2] \Gamma_{0,0} + [2\alpha_1 k_x k_y \Gamma_{+,0} + i\alpha_1 \Gamma_{+,3} (k_x^2 - k_y^2) + \alpha_2 k_z \Gamma_{+,2} + h.c.]; \\
&\quad R_{18}; \quad c_1 \sigma_0 + c_2 \sigma_1 k_z; \\
&L; R_5; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
&\quad R_{10}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
&K; R_5; \quad c_1 \sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
&\quad R_6; \quad c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
&H; \{R_7, R_8\}; \quad c_1 \Gamma_{0,0} + [\alpha_1 (k_x \Gamma_{+,3} + i k_y \Gamma_{+,0}) + \alpha_2 k_z \Gamma_{+,1} + h.c.]; \\
&\quad R_9; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
&\Delta; R_5; \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
&\quad R_6; \quad [c_1 + c_2 k_z + c_3 (k_x^2 + k_y^2) + c_4 k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
&P; R_3; \quad (c_1 + c_2 k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y); \\
&S; R_5; \quad [c_1 + c_2 (\sqrt{3} k_x + k_y)] \sigma_0 + c_3 \sigma_3 (k_x - \sqrt{3} k_y) + c_4 \sigma_1 k_z; \\
&S'; R_5; \quad (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&R; R_5; \quad (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_3 k_y + c_4 \sigma_1 k_z;
\end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
&\quad \{R_1\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
&\quad \{R_2\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_1 k_y - A_2 k_x); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_2 k_y - A_1 k_x); \\
&\quad \{R_3\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
&\quad \{R_4\}, \{R_5\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_2 k_x + A_1 k_y); \\
&\quad \{R_4\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
&\quad \{R_5\}, \{R_6\}; c_1 \Gamma_{0,0} + k_z \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
&U; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&P; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_2 c_5) k_x + [c_5 A_1 - c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
&\quad \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_1 c_5) k_x - [c_5 A_2 + c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
&T; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 (k_x - \sqrt{3} k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 (k_x - \sqrt{3} k_y); \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
&T'; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

$\Gamma_h; \{C_3^+|000\}, \{C_{21}'|000\}, \{C_2|00\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_3; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
R_{12}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
A; R_{13}; & c_1\sigma_0 + c_2\sigma_3 k_z; \\
R_{14}; & c_1\sigma_0 + c_2\sigma_3 k_z; \\
R_{15}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4\Gamma_{0,3}k_z + c_5k_z (\Gamma_{3,2}k_x + \Gamma_{0,1}k_y) + [c_4\Gamma_{+,0} (k_x^2 - k_y^2) - 2ic_4k_x k_y \Gamma_{+,3} + h.c.]; \\
L; R_5; & c_1\sigma_0 + c_2\sigma_2 k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2 k_z; \\
K; R_5; & c_1\sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
R_6; & c_1\sigma_0 + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
H; \{R_1, R_4\}; & c_1\sigma_0 + (c_2\sigma_1 - c_3\sigma_2) k_z; \\
\{R_2, R_3\}; & c_1\sigma_0 + (c_2\sigma_1 - c_3\sigma_2) k_z; \\
\{R_5, R_6\}; & c_1\Gamma_{0,0} + c_2 (\Gamma_{0,1}k_x + \Gamma_{0,3}k_y) + k_z (c_3\Gamma_{1,0} + c_4\Gamma_{2,0}); \\
\Delta; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
P; R_3; & (c_1 + c_2k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y); \\
S; \{R_2, R_4\}; & [c_1 + c_2 (\sqrt{3}k_x + k_y)] \sigma_0 + (c_3\sigma_1 + c_4\sigma_2) k_z; \\
\{R_6, R_8\}; & [c_1 + c_2 (\sqrt{3}k_x + k_y)] \sigma_0 + (c_3\sigma_1 + c_4\sigma_2) k_z; \\
S'; \{R_2, R_4\}; & (c_1 + c_2k_y) \sigma_0 + (c_3\sigma_1 + c_4\sigma_2) k_z; \\
\{R_6, R_8\}; & (c_1 + c_2k_y) \sigma_0 + (c_3\sigma_1 + c_4\sigma_2) k_z; \\
R; R_5; & (c_1 + c_2k_x) \sigma_0 + c_3\sigma_1 k_z;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_1\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_2\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_1 k_y - A_2 k_x); \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_2 k_y - A_1 k_x); \\
\{R_3\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_4\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_2 k_x + A_1 k_y); \\
\{R_4\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_5\}, \{R_6\}; & c_1 \Gamma_{0,0} + k_z \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_2 c_5) k_x + [c_5 A_1 - c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
\{R_2\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_1 c_5) k_x - [c_5 A_2 + c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
T; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 (k_x - \sqrt{3} k_y); \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 (k_x - \sqrt{3} k_y); \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
S; \{R_2, R_4\}, \{R_6, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} (\sqrt{3} k_x + k_y) + [\alpha_1 \Gamma_{1,+} (k_x - \sqrt{3} k_y) + (\alpha_2 \Gamma_{0,+} + \alpha_3 \Gamma_{3,+}) k_z + h.c.]; \\
T'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
S'; \{R_2, R_4\}, \{R_6, R_8\}; & \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} + c_{i,2} k_y) + [\alpha_1 k_x \Gamma_{1,+} + k_z (\alpha_2 \Gamma_{0,+} + \alpha_3 \Gamma_{3,+}) + h.c.]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$



$\Gamma_h; \{C_3^+|000\}, \{C_{21}'|00\frac{1}{2}\}, \{C_2|00\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_3; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
R_9; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
R_{12}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + c_4 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
A; R_{13}; & c_1\sigma_0 + c_2\sigma_3 k_z; \\
R_{14}; & c_1\sigma_0 + c_2\sigma_3 k_z; \\
R_{15}; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \Gamma_{0,0} + c_4\Gamma_{0,3}k_z + c_5k_z (\Gamma_{0,1}k_x - \Gamma_{3,2}k_y) + [c_6\Gamma_{+,0} (k_x^2 - k_y^2) - 2ic_6k_x k_y \Gamma_{+,3} + h.c.]; \\
L; R_5; & c_1\sigma_0 + c_2\sigma_2 k_z; \\
R_{10}; & c_1\sigma_0 + c_2\sigma_2 k_z; \\
K; R_5; & c_1\sigma_0 + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
R_6; & c_1\sigma_0 + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
H; R_7; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (ic_4 k_+ k_z \sigma_+ + h.c.); \\
R_8; & [c_1 + c_2(k_x^2 + k_y^2) + c_3k_z^2] \sigma_0 + (ic_4 k_- k_z \sigma_+ + h.c.); \\
R_9; & c_1\sigma_0 + c_2\sigma_2 k_z; \\
\Delta; R_5; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y - \sigma_3 (k_x^2 - k_y^2)]; \\
R_6; & [c_1 + c_2k_z + c_3(k_x^2 + k_y^2) + c_4k_z^2] \sigma_0 + c_5 [2\sigma_1 k_x k_y + \sigma_3 (k_x^2 - k_y^2)]; \\
P; R_3; & (c_1 + c_2k_z) \sigma_0 + c_3 (\sigma_1 k_x + \sigma_3 k_y); \\
S; R_5; & [c_1 + c_2 (\sqrt{3}k_x + k_y)] \sigma_0 + c_3\sigma_1 k_z; \\
S'; R_5; & (c_1 + c_2k_y)\sigma_0 + c_3\sigma_3 k_z; \\
R; \{R_2, R_4\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2) k_z; \\
\{R_6, R_8\}; & (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2) k_z;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_1\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_2\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_2\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_1 k_y - A_2 k_x); \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_3\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_2 k_y - A_1 k_x); \\
\{R_3\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_4\}, \{R_5\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + c_4 (A_2 k_x + A_1 k_y); \\
\{R_4\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z; \\
\{R_5\}, \{R_6\}; & c_1 \Gamma_{0,0} + k_z \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
U; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
P; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_2 c_5) k_x + [c_5 A_1 - c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
\{R_2\}, \{R_3\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (2A_7 c_4 - A_1 c_5) k_x - [c_5 A_2 + c_4 (A_5 - \sqrt{3} A_8)] k_y; \\
T; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 (k_x - \sqrt{3} k_y); \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 (k_x - \sqrt{3} k_y); \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y); \\
T'; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
R; \{R_2, R_4\}, \{R_6, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_x + k_y (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}) + k_z (c_4 \Gamma_{0,1} + c_5 \Gamma_{0,2} + c_6 \Gamma_{3,1} + c_7 \Gamma_{3,2});
\end{aligned}$$

SG 195

 $\Gamma_c; \{C_{31}^+|000\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned} \Gamma; \{R_2, R_3\}; & (c_1 + c_2 k^2) \sigma_0 + \sqrt{3} \sigma_1 [c_3 k_x^2 + c_4 k_y^2 - (c_3 + c_4) k_z^2] + \sigma_2 [c_4 (-2k_x^2 + k_y^2 + k_z^2) - c_3 (k_x^2 - 2k_y^2 + k_z^2)] + c_5 \sigma_3 k_x k_y k_z; \\ R_4; & c_1 A_0 + c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\ R; \{R_2, R_3\}; & (c_1 + c_2 k^2) \sigma_0 + \sqrt{3} \sigma_1 [c_3 k_x^2 + c_4 k_y^2 - (c_3 + c_4) k_z^2] + \sigma_2 [c_4 (-2k_x^2 + k_y^2 + k_z^2) - c_3 (k_x^2 - 2k_y^2 + k_z^2)] + c_5 \sigma_3 k_x k_y k_z; \\ R_4; & c_1 A_0 + c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z + c_6 \sigma_2 k_x; \\ \Lambda; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\ & \{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\ & \{R_2\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\ Z; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\ T; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_2 k_x + c_6 \sigma_1 k_y; \end{aligned}$$

SG 196

 $\Gamma_c^f; \{C_{31}^+|000\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned} \Gamma; \{R_2, R_3\}; & (c_1 + c_2 k^2) \sigma_0 + \sqrt{3} \sigma_1 [c_3 k_x^2 + c_4 k_y^2 - (c_3 + c_4) k_z^2] + \sigma_2 [c_4 (-2k_x^2 + k_y^2 + k_z^2) - c_3 (k_x^2 - 2k_y^2 + k_z^2)] + c_5 \sigma_3 k_x k_y k_z; \\ R_4; & c_1 A_0 + c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\ L; \{R_2, R_3\}; & [c_1 + c_2 (q_x^2 + q_y^2) + c_3 q_z^2] \sigma_0 + c_4 q_z \sigma_3 + [\sigma_+ (\alpha_1 q_+^2 + \alpha_2 q_z q_-) + h.c.]; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z + c_6 \sigma_2 k_x; \\ \Lambda; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\ & \{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\ & \{R_2\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\ Z; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \end{aligned}$$

SG 197

 $\Gamma_c^v; \{C_{31}^+|000\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned} \Gamma; \{R_2, R_3\}; & (c_1 + c_2 k^2) \sigma_0 + \sqrt{3} \sigma_1 [c_3 k_x^2 + c_4 k_y^2 - (c_3 + c_4) k_z^2] + \sigma_2 [c_4 (-2k_x^2 + k_y^2 + k_z^2) - c_3 (k_x^2 - 2k_y^2 + k_z^2)] + c_5 \sigma_3 k_x k_y k_z; \\ R_4; & c_1 A_0 + c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\ H; \{R_2, R_3\}; & (c_1 + c_2 k^2) \sigma_0 + \sqrt{3} \sigma_1 [c_3 k_x^2 + c_4 k_y^2 - (c_3 + c_4) k_z^2] + \sigma_2 [c_4 (-2k_x^2 + k_y^2 + k_z^2) - c_3 (k_x^2 - 2k_y^2 + k_z^2)] + c_5 \sigma_3 k_x k_y k_z; \\ R_4; & c_1 A_0 + c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\ P; R_4; & c_1 A_0 + c_2 (A_7 k_x + A_6 k_y + A_4 k_z) + c_3 (A_3 k_x - A_2 k_y + A_1 k_z); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z + c_6 \sigma_2 k_x; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
& \{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
& \{R_2\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
D; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \\
F; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} p_z + (\alpha_1 \sigma_+ p_- + h.c.); \\
& \{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} p_z + (\alpha_1 \sigma_+ p_+ + h.c.); \\
& \{R_2\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} p_z + (\alpha_1 \sigma_+ p_- + h.c.);
\end{aligned}$$

SG 198

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 $\Gamma_c; \{C_{31}^+|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_3\}; & (c_1 + c_2 k^2) \sigma_0 + \sqrt{3} \sigma_1 [c_3 k_x^2 + c_4 k_y^2 - (c_3 + c_4) k_z^2] + \sigma_2 [c_4 (-2k_x^2 + k_y^2 + k_z^2) - c_3 (k_x^2 - 2k_y^2 + k_z^2)] + c_5 \sigma_3 k_x k_y k_z; \\
& R_4; \quad c_1 A_0 + c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
X; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
M; \{R_2, R_4\}; & (c_1 + \sum_{i=x}^z c_{i,1} k_i^2) \sigma_0 + [\alpha_1 \sigma_+ k_x k_y + h.c.]; \\
& \{R_6, R_8\}; (c_1 + \sum_{i=x}^z c_{i,1} k_i^2) \sigma_0 + [\alpha_1 \sigma_+ k_x k_y + h.c.]; \\
R; \{R_4, R_4\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,1} k_x - \Gamma_{0,2} k_y - \Gamma_{0,3} k_z); \\
& \{R_5, R_6\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x - \Gamma_{0,2} k_y - \Gamma_{3,3} k_z); \\
S; \{R_1, R_1\}; & \sigma_0 (c_2 k_x + c_3 k_z + c_1) + \sum_{i=1}^3 c_{i,1} \sigma_i k_y; \\
Z; \{R_2, R_4\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
T; \{R_2, R_2\}; & \sigma_0 (c_1 + c_2 k_z + \sum_{i=x}^z c_{i,1} k_i^2) + c_3 \sigma_3 k_x k_y + [\alpha_1 \sigma_+ k_x k_y + h.c.]; \\
& \{R_4, R_4\}; \sigma_0 (c_1 + c_2 k_z + \sum_{i=x}^z c_{i,1} k_i^2) + c_3 \sigma_3 k_x k_y + [\alpha_1 \sigma_+ k_x k_y + h.c.];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z + c_6 \sigma_2 k_x; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
& \{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
& \{R_2\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
T; \{R_2, R_2\}, \{R_4, R_4\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_z + c_2 \Gamma_{2,0} k_x + c_3 \Gamma_{1,0} k_y + \sum_{i=1}^3 (c_{i,2} \Gamma_{1,i} k_x + c_{i,3} \Gamma_{2,i} k_y);
\end{aligned}$$

SG 199

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 $\Gamma_c^v; \{C_{31}^+|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_3\}; & (c_1 + c_2 k^2) \sigma_0 + \sqrt{3} [c_3 k_x^2 + c_4 k_y^2 - (c_3 + c_4) k_z^2] \sigma_1 + [c_4 (-2k_x^2 + k_y^2 + k_z^2) - c_3 (k_x^2 - 2k_y^2 + k_z^2)] \sigma_2 + c_5 \sigma_3 k_x k_y k_z; \\
& R_4; \quad c_1 A_0 + c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
H; \{R_5, R_6\}; & (c_1 + c_2 k^2) \sigma_0 + \sqrt{3} [c_3 (k_x^2 - k_y^2) + c_4 (k_z^2 - k_y^2)] \sigma_1 + [c_4 (-2k_x^2 + k_y^2 + k_z^2) - c_3 (k_x^2 + k_y^2 - 2k_z^2)] \sigma_2 + c_5 \sigma_3 k_x k_y k_z; \\
& R_8; \quad A_0 c_1 + c_2 (A_3 k_x + A_1 k_y - A_2 k_z); \\
P; R_7; & c_1 \sigma_0 + c_2 q_z \sigma_3 + c_2 (q_- \sigma_+ + h.c.); \\
& R_8; \quad c_1 \sigma_0 + c_2 q_z \sigma_3 + c_2 (q_- \sigma_+ + h.c.); \\
& R_9; \quad c_1 \sigma_0 + c_2 q_z \sigma_3 + c_2 (q_- \sigma_+ + h.c.);
\end{aligned}$$

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z + c_6 \sigma_2 k_x; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
& \{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
& \{R_2\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
D; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y); \\
F; \{R_2\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} p_z + (\alpha_1 \sigma_+ p_- + h.c.); \\
& \{R_2\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} p_z + (\alpha_1 \sigma_+ p_+ + h.c.); \\
& \{R_4\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} p_z + (\alpha_1 \sigma_+ p_- + h.c.);
\end{aligned}$$

SG 200

 $\Gamma_c; \{S_{61}^+|000\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_3\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_4; & c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\{R_6, R_7\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_8; & c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R; \{R_2, R_3\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_4; & c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\{R_6, R_7\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_8; & c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\Lambda; \{R_2, R_3\}; & (c_1 + c_2 q_z) \sigma_0 + (\alpha_1 \sigma_+ q_- + h.c.);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
\Lambda; \{R_1\}, \{R_2, R_3\}; & \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + (c_4 q_x - c_5 q_y) (A_4 + A_6) + (c_4 q_y + c_5 q_x) (A_1 - A_2) + \\
& \quad A_7 (c_6 q_x - c_7 q_y) + A_3 (c_7 q_x + c_6 q_y); \\
S; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_z) + \sigma_3 (c_4 k_x + c_5 k_z) + c_6 \sigma_1 k_y; \\
Z; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
T; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

SG 201

 $\Gamma_c; \{S_{61}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2z} | 000\}, \{C_{2y} | 000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; \{R_2, R_3\}; (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
&\quad R_4; \quad c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&\quad \{R_6, R_7\}; (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
&\quad R_8; \quad c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&X; R_5; \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
&\quad R_{10}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
&M; R_5; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
&\quad R_{10}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
&R; \{R_2, R_3\}; (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
&\quad R_4; \quad c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&\quad \{R_6, R_7\}; (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
&\quad R_8; \quad c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&\Lambda; \{R_2, R_3\}; (c_1 + c_2 q_z) \sigma_0 + (\alpha_1 \sigma_+ q_- + h.c.); \\
&Z; R_5; \quad (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Sigma; \{R_1\}, \{R_2\}; \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
&\Lambda; \{R_1\}, \{R_2, R_3\}; \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_4 (A_4 + A_6) + c_5 (A_1 - A_2) + A_7 c_6 + A_3 c_7] q_x + \\
&\quad [c_4 (A_1 - A_2) - c_5 (A_4 + A_6) + A_3 c_6 - A_7 c_7] q_y; \\
&S; \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_z) + \sigma_3 (c_4 k_x + c_5 k_z) + c_6 \sigma_1 k_y; \\
&T; \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_4\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_y; \\
&\quad \{R_4\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 k_x; \\
&\quad \{R_6\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

SG 202

 $\Gamma_c^f; \{S_{61}^+|000\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_3\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_4; & c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\{R_6, R_7\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_8; & c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
L; \{R_2, R_6\}; & (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + [(\alpha_1 q_+^2 + \alpha_2 q_z q_-) \sigma_+ + h.c.]; \\
\{R_3, R_5\}; & (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + [(\alpha_1 q_-^2 + \alpha_2 q_z q_+) \sigma_+ + h.c.]; \\
\Lambda; \{R_2, R_3\}; & (c_1 + c_2 q_z) \sigma_0 + (\alpha_1 \sigma_+ q_- + h.c.);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; \{R_1\}, \{R_2, R_3\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_4 (A_4 + A_6) + c_5 (A_1 - A_2) + A_7 c_6 + A_3 c_7] q_x + \\
& [c_4 (A_1 - A_2) - c_5 (A_4 + A_6) + A_3 c_6 - A_7 c_7] q_y; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
S; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x + c_3 k_z) + \sigma_3 (c_4 k_x + c_5 k_z) + c_6 \sigma_1 k_y; \\
Z; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

SG 203

 $\Gamma_c^f; \{S_{61}^+|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_3\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_4; & c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\{R_6, R_7\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_8; & c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; R_5; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
L; \{R_2, R_6\}; & (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + [(\alpha_1 q_+^2 + \alpha_2 q_z q_-) \sigma_+ + h.c.]; \\
\{R_3, R_5\}; & (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + [(\alpha_1 q_-^2 + \alpha_2 q_z q_+) \sigma_+ + h.c.]; \\
W; R_9; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_3 k_y + c_4 \sigma_1 k_z; \\
\Lambda; \{R_2, R_3\}; & (c_1 + c_2 q_z) \sigma_0 + (\alpha_1 \sigma_+ q_- + h.c.); \\
Z; R_5; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 k_z;
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; \{R_1\}, \{R_2, R_3\}; & \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_4 (A_4 + A_6) + c_5 (A_1 - A_2) + A_7 c_6 + A_3 c_7] q_x + \\
& \quad [c_4 (A_1 - A_2) - c_5 (A_4 + A_6) + A_3 c_6 - A_7 c_7] q_y; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
S; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_z) + \sigma_3 (c_4 k_x + c_5 k_z) + c_6 \sigma_1 k_y;
\end{aligned}$$

SG 204

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 $\Gamma_c^v; \{S_{61}^+|000\}, \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_3\}; & \quad (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_4; & \quad c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\{R_6, R_7\}; & \quad (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_8; & \quad c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
H; \{R_2, R_3\}; & \quad (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_4; & \quad c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\{R_6, R_7\}; & \quad (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_8; & \quad c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
P; \{R_2, R_3\}; & \quad (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (q_+^2 + 2\sqrt{2} q_- q_z) \sigma_+ + h.c.]; \\
R_4; & \quad c_1 A_0 + c_2 (A_7 k_x + A_6 k_y + A_4 k_z); \\
\Lambda; \{R_2, R_3\}; & \quad (c_1 + c_2 q_z) \sigma_0 + (\alpha_1 \sigma_+ q_- + h.c.); \\
F; \{R_2, R_3\}; & \quad (c_1 + c_2 p_z) \sigma_0 + (\alpha_1 \sigma_+ p_- + h.c.);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; \{R_1\}, \{R_2, R_3\}; & \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_4 (A_4 + A_6) + c_5 (A_1 - A_2) + A_7 c_6 + A_3 c_7] q_x + \\
& \quad [c_4 (A_1 - A_2) - c_5 (A_4 + A_6) + A_3 c_6 - A_7 c_7] q_y; \\
D; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + \sigma_1 (c_4 k_x + c_5 k_y); \\
G; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
F; \{R_1\}, \{R_2, R_3\}; & \quad A_0 (c_1 + c_2 p_z) + (\sqrt{3} A_5 + A_8) c_3 p_z - [c_4 (A_4 + A_6) + A_7 c_5] (\sqrt{3} p_x + p_y) + \\
& \quad [c_4 (A_1 - A_2) + A_3 c_5] (p_x - \sqrt{3} p_y) + c_6 [(A_2 - A_1) p_x + (A_4 + A_6) p_y] + c_7 (A_7 p_y - A_3 p_x);
\end{aligned}$$

$\Gamma_c; \{S_{61}^+|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; \{R_2, R_3\}; \quad (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
&\quad R_4; \quad c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, \quad c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, \quad c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&\quad \{R_6, R_7\}; \quad (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
&\quad R_8; \quad c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, \quad c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, \quad c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&X; R_5; \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
&\quad R_{10}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
&M; \{R_9, R_{10}\}; \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_x + k_y (c_3 \Gamma_{1,2} + c_4 \Gamma_{2,2}); \\
&R; \{R_4, R_4\}; \quad (c_1 + c_2 q^2) \Gamma_{0,0} + \sum_i c_{1,i} \left\{ \Gamma_{i,3} (q_x^2 + q_y^2 - 2q_z^2) - \left[ \sqrt{2} e^{i\frac{7\pi}{12}} \Gamma_{i,+} (\sqrt{2} q_+ q_z - q_-^2) + h.c. \right] \right\}; \\
&\quad \{R_5, R_6\}; \quad c_1 \Gamma_{0,0}; \\
&\quad \{R_{11}, R_{11}\}; \quad (c_1 + c_2 q^2) \Gamma_{0,0} + \sum_i c_{1,i} \left\{ \Gamma_{i,3} (q_x^2 + q_y^2 - 2q_z^2) - \left[ \sqrt{2} e^{i\frac{7\pi}{12}} \Gamma_{i,+} (\sqrt{2} q_+ q_z - q_-^2) + h.c. \right] \right\}; \\
&\quad \{R_{12}, R_{13}\}; \quad c_1 \Gamma_{0,0}; \\
&\Lambda; \{R_2, R_3\}; \quad (c_1 + c_2 q_z) \sigma_0 + (\alpha_1 \sigma_+ q_- + h.c.); \\
&S; \{R_2, R_4\}; \quad (c_1 + c_2 k_x + c_3 k_z) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&Z; \{R_2, R_4\}; \quad (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
&\quad \{R_6, R_8\}; \quad (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
&T; \{R_5, R_5\}; \quad (c_1 + c_2 k_z) \Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,3} k_x + c_{i,2} \Gamma_{i,1} k_y); \\
&Z'; R_5; \quad (c_1 + c_2 k_y) \sigma_0 + c_3 \sigma_1 k_x;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_3\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
&\quad \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\Sigma; \{R_1\}, \{R_2\}; \quad \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
&\Lambda; \{R_1\}, \{R_2, R_3\}; \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_4 (A_4 + A_6) + c_5 (A_1 - A_2) + A_7 c_6 + A_3 c_7] q_x + \\
&\quad [c_4 (A_1 - A_2 c_5) - c_5 (A_4 + A_6) + A_3 c_6 - A_7 c_7] q_y; \\
&Z; \{R_2, R_4\}, \{R_6, R_8\}; \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} k_x + k_y (c_2 \Gamma_{0,1} - c_3 \Gamma_{0,2} + c_4 \Gamma_{3,1} + c_5 \Gamma_{3,2}) + k_z (c_6 \Gamma_{1,1} - c_7 \Gamma_{1,2});
\end{aligned}$$

SG 206

 $\Gamma_c^-; \{S_{61}^+|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \{R_2, R_3\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_4; & c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\{R_6, R_7\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_z q_- + q_+^2) \sigma_+ + h.c.]; \\
R_8; & c_1 A_0 + \text{diag} [c_2 k_x^2 + c_3 k_z^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_x^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_y^2 + c_4 k_x^2] + c_5 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
H; \{R_5, R_6\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_+ q_z + q_-^2) \sigma_+ + h.c.]; \\
R_8; & A_0 c_1 + \text{diag} [c_2 k_x^2 + c_3 k_y^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_x^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_z^2 + c_4 k_x^2] + c_5 (A_6 k_x k_y + A_4 k_x k_z + A_7 k_y k_z); \\
\{R_{13}, R_{14}\}; & (c_1 + c_2 q^2) \sigma_0 + [\alpha_1 (2\sqrt{2} q_+ q_z + q_-^2) \sigma_+ + h.c.]; \\
R_{16}; & A_0 c_1 + \text{diag} [c_2 k_x^2 + c_3 k_y^2 + c_4 k_z^2, c_2 k_z^2 + c_3 k_x^2 + c_4 k_y^2, c_2 k_y^2 + c_3 k_z^2 + c_4 k_x^2] + c_5 (A_6 k_x k_y + A_4 k_x k_z + A_7 k_y k_z); \\
P; \{R_7, R_7\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 c_{i,1} [\Gamma_{i,3} q_z + ((-1)^{5/12} q_- \Gamma_{i,+} + h.c.)] \\
N; R_5; & c_1 \sigma_0 + \sigma_2 (c_2 k_x + c_3 k_y); \\
\Lambda; \{R_2, R_3\}; & (c_1 + c_2 q_z) \sigma_0 + (\alpha_1 \sigma_+ q_- + h.c.); \\
D; \{R_2, R_4\}; & (c_1 + c_2 k_z) \sigma_0 + \sigma_1 (c_3 k_x + c_4 k_y) + \sigma_2 (c_5 k_x + c_6 k_y); \\
F; \{R_2, R_6\}; & (c_1 + c_2 p_z) \sigma_0 + (\alpha_1 \sigma_+ p_+ + h.c.);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_x; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 \sigma_1 k_z; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\Lambda; \{R_1\}, \{R_2, R_3\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_4 (A_4 + A_6) + c_5 (A_1 - A_2) + A_7 c_6 + A_3 c_7] q_x + \\
& [c_4 (A_1 - A_2 c_5) - c_5 (A_4 + A_6) + A_3 c_6 - A_7 c_7] q_y; \\
G; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + c_6 \sigma_1 k_z; \\
F; \{R_2, R_6\}, \{R_4\}; & A_0 (c_1 + c_2 p_z) + A_8 c_3 p_z + [(\sqrt{3} A_4 + A_1) c_5 + [\sqrt{3} (A_6 + A_7) + A_3 - A_2] c_4 - A_1 c_6 + (A_3 - A_2) c_7] p_x + \\
& [(A_4 - \sqrt{3} A_1) c_5 + [\sqrt{3} (A_2 - A_3) + A_6 + A_7] c_4 + A_4 c_6 + (A_6 + A_7) c_7] p_y
\end{aligned}$$

SG 207

 $\Gamma_c^-; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{C_{2a}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_3; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sqrt{3} (k_x^2 - k_y^2) \sigma_1 + (k_x^2 + k_y^2 - 2k_z^2) \sigma_3] + c_4 k_x k_y k_z \sigma_2 \\
R_4; & A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
R_5; & A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
X; R_5; & \sigma_0 (c_1 + c_2 k^2 + c_3 k_y^2) + c_4 \sigma_1 k_x k_z + c_5 \sigma_3 (k_x^2 - k_z^2) + c_6 \sigma_2 k_y; \\
M; R_5; & \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2) + c_4 \sigma_1 k_x k_y + c_5 \sigma_3 (k_x^2 - k_y^2) + c_6 \sigma_2 k_z; \\
R; R_3; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sqrt{3} (k_x^2 - k_y^2) \sigma_1 + (k_x^2 + k_y^2 - 2k_z^2) \sigma_3] + c_4 k_x k_y k_z \sigma_2 \\
R_4; & A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
R_5; & A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z);
\end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\{R_1\}, \{R_3\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_xk_z + ic_3(k_x^2 - k_z^2)) + h.c.]; \\
&\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 + \sigma_2)k_x + (\sigma_2 - \sigma_1)k_z]; \\
&\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_xk_z + ic_3(k_x^2 - k_z^2)) + h.c.]; \\
&\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_x + c_{i,1}k_y) + c_2\sigma_2(k_y - k_x) + c_3\sigma_1k_z; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 - \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 + \sigma_2)q_y]; \\
&\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 + \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 - \sigma_2)q_y]; \\
&\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 - \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 + \sigma_2)q_y]; \\
&S; \{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_x + c_{i,2}k_z) + c_2\sigma_2(k_z - k_x) + c_3\sigma_1k_y; \\
&Z; \{R_1\}, \{R_2\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i c_{i,1}k_x + c_2\sigma_2k_y + c_3\sigma_1k_z; \\
&T; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_x + \sigma_2k_y); \\
&\{R_1\}, \{R_3\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + \{\sigma_+[c_2(k_x^2 - k_y^2) + ic_3k_xk_y] + h.c.\}; \\
&\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_x - \sigma_2k_y); \\
&\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_x + \sigma_2k_y); \\
&\{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + \{\sigma_+[c_2(k_x^2 - k_y^2) + ic_3k_xk_y] + h.c.\}; \\
&\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_x + \sigma_2k_y);
\end{aligned}$$

SG 208

 $\Gamma_c; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; R_3; (c_1 + c_2k^2)\sigma_0 + c_3[\sqrt{3}(k_x^2 - k_y^2)\sigma_1 + (k_x^2 + k_y^2 - 2k_z^2)\sigma_3] + c_4k_xk_yk_z\sigma_2 \\
&R_4; A_0c_1 - c_2(A_3k_x - A_2k_y + A_1k_z); \\
&R_5; A_0c_1 - c_2(A_3k_x - A_2k_y + A_1k_z); \\
&X; R_5; \sigma_0(c_1 + c_2k^2 + c_3k_y^2) + c_4\sigma_1k_xk_z + c_5\sigma_3(k_x^2 - k_z^2) + c_6\sigma_2k_y; \\
&M; R_5; \sigma_0(c_1 + c_2k^2 + c_3k_z^2) + c_4\sigma_1k_xk_y + c_5\sigma_3(k_x^2 - k_y^2) + c_6\sigma_2k_z; \\
&R; R_3; (c_1 + c_2k^2)\sigma_0 + c_3[\sqrt{3}(k_x^2 - k_y^2)\sigma_1 + (k_x^2 + k_y^2 - 2k_z^2)\sigma_3] + c_4k_xk_yk_z\sigma_2 \\
&R_4; A_0c_1 - c_2(A_3k_x - A_2k_y + A_1k_z); \\
&R_5; A_0c_1 - c_2(A_3k_x - A_2k_y + A_1k_z);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\{R_1\}, \{R_3\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_xk_z + ic_3(k_x^2 - k_z^2)) + h.c.]; \\
&\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 + \sigma_2)k_x + (\sigma_2 - \sigma_1)k_z]; \\
&\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_xk_z + ic_3(k_x^2 - k_z^2)) + h.c.]; \\
&\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_x + c_{i,1}k_y) + c_2\sigma_2(k_y - k_x) + c_3\sigma_1k_z; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 - \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 + \sigma_2)q_y]; \\
&\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 + \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 - \sigma_2)q_y]; \\
&\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 - \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 + \sigma_2)q_y]; \\
&S; \{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_x + c_{i,2}k_z) + c_2\sigma_2(k_z - k_x) + c_3\sigma_1k_y; \\
&Z; \{R_1\}, \{R_2\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i c_{i,1}k_x + c_2\sigma_2k_y + c_3\sigma_1k_z; \\
&T; \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_x + \sigma_2k_y); \\
&\{R_5\}, \{R_7\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + \{\sigma_+[c_2(k_x^2 - k_y^2) + ic_3k_xk_y] + h.c.\}; \\
&\{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_x - \sigma_2k_y); \\
&\{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_x + \sigma_2k_y); \\
&\{R_6\}, \{R_8\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + \{\sigma_+[c_2(k_x^2 - k_y^2) + ic_3k_xk_y] + h.c.\}; \\
&\{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + c_3\sigma_3k_z + c_5(\sigma_1k_x + \sigma_2k_y);
\end{aligned}$$

SG 209

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 $\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{C_{2a}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; \quad R_3; \quad (c_1 + c_2k^2)\sigma_0 + c_3[\sqrt{3}(k_x^2 - k_y^2)\sigma_1 + (k_x^2 + k_y^2 - 2k_z^2)\sigma_3] + c_4k_xk_yk_z\sigma_2 \\
&\quad R_4; \quad A_0c_1 - c_2(A_3k_x - A_2k_y + A_1k_z); \\
&\quad R_5; \quad A_0c_1 - c_2(A_3k_x - A_2k_y + A_1k_z); \\
&X; \quad R_5; \quad \sigma_0(c_1 + c_2k^2 + c_3k_y^2) + c_4\sigma_1k_xk_z + c_5\sigma_3(k_x^2 - k_z^2) + c_6\sigma_2k_y; \\
&L; \quad R_3; \quad [c_1 + c_2(q_x^2 + q_y^2) + c_3q_z^2]\sigma_0 + [c_4(q_x^2 - q_y^2) - c_5q_xq_z]\sigma_3 + [(2c_4q_xq_y + c_5q_yq_z + ic_6q_z)\sigma_+ + h.c.]; \\
&W; \{R_3, R_4\}; (c_1 + c_2k^2 + c_3k_z^2)\sigma_0 + c_6\sigma_3k_yk_z + [\sigma_+(\alpha_1k_x + \alpha_2(k_y^2 - k_z^2)) + h.c.];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\{R_1\}, \{R_3\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_xk_z + ic_3(k_x^2 - k_z^2)) + h.c.]; \\
&\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 + \sigma_2)k_x + (\sigma_2 - \sigma_1)k_z]; \\
&\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_xk_z + ic_3(k_x^2 - k_z^2)) + h.c.]; \\
&\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 - \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 + \sigma_2)q_y]; \\
&\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 + \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 - \sigma_2)q_y]; \\
&\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 - \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 + \sigma_2)q_y]; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_x + c_{i,1}k_y) + c_2\sigma_2(k_y - k_x) + c_3\sigma_1k_z; \\
&S; \{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_x + c_{i,2}k_z) + c_2\sigma_2(k_z - k_x) + c_3\sigma_1k_y; \\
&Z; \{R_1\}, \{R_2\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i c_{i,1}k_x + c_2\sigma_2k_y + c_3\sigma_1k_z; \\
&Q; \{R_4\}, \{R_8\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y - c_{i,1}k_z) + \sum_{i=1}^2\sigma_1[c_{i,2}k_x + c_{i,3}(k_y + k_z)];
\end{aligned}$$

SG 210

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 $\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{C_{2a}|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; R_3; (c_1 + c_2k^2)\sigma_0 + c_3[\sqrt{3}(k_x^2 - k_y^2)\sigma_1 + (k_x^2 + k_y^2 - 2k_z^2)\sigma_3] + c_4k_xk_yk_z\sigma_2 \\
&R_4; A_0c_1 - c_2(A_3k_x - A_2k_y + A_1k_z); \\
&R_5; A_0c_1 - c_2(A_3k_x - A_2k_y + A_1k_z); \\
&X; R_5; (c_1 + c_2k^2 + c_3k_y^2)\sigma_0 + c_4\sigma_1k_xk_z + c_5\sigma_3(k_x^2 - k_z^2) + c_6\sigma_2k_y \\
&L; R_3; [c_1 + c_2(q_x^2 + q_y^2) + c_3q_z^2]\sigma_0 + [c_4(q_x^2 - q_y^2) - c_5q_xq_z]\sigma_3 + [(2c_4q_xq_y + c_5q_yq_z + ic_6q_z)\sigma_+ + h.c.]; \\
&W; R_{10}; c_1\sigma_0 + c_2\sigma_1k_x + c_3[\sigma_2(k_y + k_z) + \sigma_3(k_y - k_z)];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\{R_1\}, \{R_3\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_xk_z + ic_3(k_x^2 - k_z^2)) + h.c.]; \\
&\{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 + \sigma_2)k_x + (\sigma_2 - \sigma_1)k_z]; \\
&\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_xk_z + ic_3(k_x^2 - k_z^2)) + h.c.]; \\
&\{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + c_3\sigma_3k_y + c_5[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_z]; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 - \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 + \sigma_2)q_y]; \\
&\{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 + \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 - \sigma_2)q_y]; \\
&\{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + c_4[(\sigma_1 - \sqrt{3}\sigma_2)q_x + (\sqrt{3}\sigma_1 + \sigma_2)q_y]; \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_x + c_{i,1}k_y) + c_2\sigma_2(k_y - k_x) + c_3\sigma_1k_z; \\
&S; \{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_x + c_{i,2}k_z) + c_2\sigma_2(k_z - k_x) + c_3\sigma_1k_y; \\
&Z; \{R_1\}, \{R_2\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i c_{i,1}k_x + c_2\sigma_2k_y + c_3\sigma_1k_z; \\
&Q; \{R_4\}, \{R_8\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y - c_{i,1}k_z) + \sum_{i=1}^2\sigma_1[c_{i,2}k_x + c_{i,3}(k_y + k_z)];
\end{aligned}$$

SG 211

 $\Gamma_c^u; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{C_{2a}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; R_3; (c_1 + c_2 k^2) \sigma_0 + c_3 [\sqrt{3}(k_x^2 - k_y^2) \sigma_1 + (k_x^2 + k_y^2 - 2k_z^2) \sigma_3] + c_4 k_x k_y k_z \sigma_2 \\
&\quad R_4; A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
&\quad R_5; A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
&H; R_3; (c_1 + c_2 k^2) \sigma_0 + c_3 [\sqrt{3}(k_x^2 - k_y^2) \sigma_1 + (k_x^2 + k_y^2 - 2k_z^2) \sigma_3] + c_4 k_x k_y k_z \sigma_2 \\
&\quad R_4; A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
&\quad R_5; A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
&P; R_4; c_1 A_0 + c_2 (A_7 k_x + A_6 k_y + A_4 k_z) + c_3 (A_3 k_x - A_2 k_y + A_1 k_z);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z + c_6 \sigma_2 (k_y - k_x); \\
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x k_z + i c_3 (k_x^2 - k_z^2)) + h.c.]; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 + \sigma_2) k_x + (\sigma_2 - \sigma_1) k_z]; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x k_z + i c_3 (k_x^2 - k_z^2)) + h.c.]; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 - \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 + \sigma_2) q_y]; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 + \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 - \sigma_2) q_y]; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 - \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 + \sigma_2) q_y]; \\
&D; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x + k_y) + c_6 \sigma_2 (k_y - k_x); \\
&G; \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_4 \sigma_1 (k_x + k_y) + c_5 \sigma_2 k_z; \\
&F; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 p_z) + c_3 \sigma_3 p_z + c_5 [(\sigma_1 + \sqrt{3} \sigma_2) p_x + (\sigma_2 - \sqrt{3} \sigma_1) p_y]; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 p_z) + c_3 \sigma_3 p_z + c_5 [(\sqrt{3} \sigma_2 - \sigma_1) p_x + (\sqrt{3} \sigma_1 + \sigma_2) p_y]; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 p_z) + c_3 \sigma_3 p_z + c_5 [(\sigma_1 + \sqrt{3} \sigma_2) p_x + (\sigma_2 - \sqrt{3} \sigma_1) p_y];
\end{aligned}$$

$\Gamma_c; \{C_{31}|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{C_{2a}|\frac{1}{4}\frac{3}{4}\frac{3}{4}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_3; & \quad (c_1 + c_2 k^2) \sigma_0 + c_3 [\sqrt{3}(k_x^2 - k_y^2) \sigma_1 + (k_x^2 + k_y^2 - 2k_z^2) \sigma_3] + c_4 k_x k_y k_z \sigma_2 \\
R_4; & \quad A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
R_5; & \quad A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
X; \quad R_6; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
R_7; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
M; \quad \{R_5, R_6\}; & \quad (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 \sigma_2 k_x k_y; \\
\{R_7, R_8\}; & \quad (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 \sigma_2 k_x k_y; \\
R_9; & \quad (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x k_y; \\
R; \quad \{R_4, R_5\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} q_x + \Gamma_{3,1} q_y - \Gamma_{3,3} q_z); \\
R_8; & \quad c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,2} (k_x + k_y) + \Gamma_{3,3} (k_x - k_y) + \sqrt{2} \Gamma_{3,1} k_z]; \\
S; \quad \{R_4, R_8\}; & \quad (c_1 + c_2 (k_x + k_z)) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
Z; \quad \{R_2, R_4\}; & \quad (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
T; \quad \{R_5, R_7\}; & \quad (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_2 k_x k_y; \\
\{R_6, R_8\}; & \quad (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_2 k_x k_y;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x k_z + i c_3 (k_x^2 - k_z^2)) + h.c.]; \\
\{R_1\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 + \sigma_2) k_x + (\sigma_2 - \sigma_1) k_z]; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
\{R_2\}, \{R_4\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x k_z + i c_3 (k_x^2 - k_z^2)) + h.c.]; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
\Sigma; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z + c_6 \sigma_2 (k_y - k_x); \\
\Lambda; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 - \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 + \sigma_2) q_y]; \\
\{R_1\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 + \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 - \sigma_2) q_y]; \\
\{R_2\}, \{R_3\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 - \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 + \sigma_2) q_y]; \\
T; \quad \{R_5, R_7\}, \{R_6, R_8\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_2 k_z + c_3 (\Gamma_{1,0} k_x + \Gamma_{2,0} k_y) + [k_x (\alpha \Gamma_{2,+} - c_4 \Gamma_{2,3}) + k_y (\alpha \Gamma_{1,+} + c_4 \Gamma_{1,3}) + h.c.];
\end{aligned}$$



SG 213

 $\Gamma_c; \{C_{31}^-|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{C_{2a}|\frac{3}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_3; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sqrt{3}(k_x^2 - k_y^2) \sigma_1 + (k_x^2 + k_y^2 - 2k_z^2) \sigma_3] + c_4 k_x k_y k_z \sigma_2 \\
R_4; & A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
R_5; & A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
X; R_6; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
R_7; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
M; \{R_5, R_6\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 \sigma_2 k_x k_y; \\
\{R_7, R_8\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 \sigma_2 k_x k_y; \\
R_9; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x k_y; \\
R; \{R_4, R_5\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} q_x + \Gamma_{3,1} q_y - \Gamma_{3,3} q_z); \\
R_8; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,2} (k_x + k_y) + \Gamma_{3,3} (k_x - k_y) + \sqrt{2} \Gamma_{3,1} k_z]; \\
S; \{R_2, R_6\}; & (c_1 + c_2 (k_x + k_z)) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
Z; \{R_2, R_4\}; & (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
T; \{R_5, R_7\}; & (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_2 k_x k_y; \\
\{R_6, R_8\}; & (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_2 k_x k_y;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
\{R_1\}, \{R_3\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x k_z + i c_3 (k_x^2 - k_z^2)) + h.c.]; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 + \sigma_2) k_x + (\sigma_2 - \sigma_1) k_z]; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
\{R_2\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x k_z + i c_3 (k_x^2 - k_z^2)) + h.c.]; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z + c_6 \sigma_2 (k_y - k_x); \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 - \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 + \sigma_2) q_y]; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 + \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 - \sigma_2) q_y]; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 - \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 + \sigma_2) q_y]; \\
T; \{R_5, R_7\}, \{R_6, R_8\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} c_2 k_z + c_3 (\Gamma_{1,0} k_x + \Gamma_{2,0} k_y) + [k_x (\alpha \Gamma_{2,+} - c_4 \Gamma_{2,3}) + k_y (\alpha \Gamma_{1,+} + c_4 \Gamma_{1,3}) + h.c.];
\end{aligned}$$

SG 214

 $\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{C_{2a}|\frac{1}{2}00\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 

$$\begin{aligned}
\Gamma; R_3; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sqrt{3}(k_x^2 - k_y^2) \sigma_1 + (k_x^2 + k_y^2 - 2k_z^2) \sigma_3] + c_4 k_x k_y k_z \sigma_2 \\
R_4; & A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
R_5; & A_0 c_1 - c_2 (A_3 k_x - A_2 k_y + A_1 k_z); \\
H; R_6; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sqrt{3} \sigma_1 (k_x^2 - k_z^2) + \sigma_3 (k_x^2 + k_z^2 - 2k_y^2)] + c_4 \sigma_2 k_x k_y k_z; \\
R_9; & A_0 c_1 - c_2 (A_3 k_x + A_1 k_y + A_2 k_z); \\
R_{10}; & A_0 c_1 - c_2 (A_3 k_x + A_1 k_y + A_2 k_z); \\
P; R_7; & c_1 \sigma_0 + c_2 \left\{ q_z \sigma_3 - \left[ (-1)^{7/12} q_+ \sigma_- + h.c. \right] \right\}; \\
R_8; & c_1 \sigma_0 + c_2 \left\{ q_z \sigma_3 - \left[ (-1)^{7/12} q_+ \sigma_- + h.c. \right] \right\}; \\
R_9; & c_1 \sigma_0 + c_2 \left\{ q_z \sigma_3 - \left[ (-1)^{7/12} q_+ \sigma_- + h.c. \right] \right\};
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z + c_6 \sigma_2 (k_y - k_x); \\
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x k_z + i c_3 (k_x^2 - k_z^2)) + h.c.]; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 + \sigma_2) k_x + (\sigma_2 - \sigma_1) k_z]; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x k_z + i c_3 (k_x^2 - k_z^2)) + h.c.]; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y + c_5 [(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_z]; \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 - \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 + \sigma_2) q_y]; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 + \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 - \sigma_2) q_y]; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + c_4 [(\sigma_1 - \sqrt{3} \sigma_2) q_x + (\sqrt{3} \sigma_1 + \sigma_2) q_y]; \\
&D; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x + k_y) + c_6 \sigma_2 (k_y - k_x); \\
&G; \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_4 \sigma_1 (k_x + k_y) + c_5 \sigma_2 k_z; \\
&F; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 p_z) + c_3 \sigma_3 p_z + c_5 [(\sigma_1 + \sqrt{3} \sigma_2) p_x + (\sigma_2 - \sqrt{3} \sigma_1) p_y]; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 p_z) + c_3 \sigma_3 p_z + c_5 [(\sqrt{3} \sigma_2 - \sigma_1) p_x + (\sqrt{3} \sigma_1 + \sigma_2) p_y]; \\
&\quad \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 p_z) + c_3 \sigma_3 p_z + c_5 [(\sigma_1 + \sqrt{3} \sigma_2) p_x + (\sigma_2 - \sqrt{3} \sigma_1) p_y];
\end{aligned}$$

SG 215

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 $\Gamma_c; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{\sigma_{da}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_3; \quad & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_y^2 - k_x^2) - \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
\quad R_4; \quad & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\quad R_5; \quad & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; \quad R_5; \quad & (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_1 k_x k_z + c_5 \sigma_3 (k_x^2 - k_z^2); \\
M; \quad R_5; \quad & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 \sigma_3 (k_x^2 - k_y^2); \\
R; \quad R_3; \quad & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_y^2 - k_x^2) - \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
\quad R_4; \quad & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\quad R_5; \quad & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\Delta; \{R_3, R_4\}; \quad & (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_5 \sigma_3 k_x k_z + [\alpha_1 \sigma_+ (k_x^2 - k_z^2) + h.c.]; \\
\Lambda; \quad R_3; \quad & (c_1 + c_2 q_z) \sigma_0 + c_3 (\sigma_1 q_y - \sigma_3 q_x); \\
T; \quad \{R_3, R_4\}; \quad & (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) \sigma_0 + c_5 \sigma_3 k_x k_y + [\alpha_1 \sigma_+ (k_x^2 - k_y^2) + h.c.];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3, R_4\}; & \quad A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_x + [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_z; \\
\{R_2\}, \{R_3, R_4\}; & \quad A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y - [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_x + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_z; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
\{R_1\}, \{R_3\}; & \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2\sqrt{2} (A_1 c_6 - A_4 c_4)] q_x + \\
& \quad 2 [\sqrt{3} (A_2 c_6 - A_6 c_4) + A_7 c_5] q_y; \\
\{R_2\}, \{R_3\}; & \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2 (A_2 c_6 - A_6 c_4)] q_x + 2 (A_4 c_4 + A_7 c_5 - A_1 c_6) q_y; \\
S; \{R_1\}, \{R_2\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z) + c_5 \sigma_2 (k_z - k_x); \\
Z; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y + c_6 \sigma_1 k_z; \\
T; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3, R_4\}; & \quad A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + [(A_6 - A_4) c_5 + (A_1 + A_2) c_6] k_x + [(A_4 + A_6) c_5 + (A_2 - A_1) c_6] k_y; \\
\{R_2\}, \{R_3, R_4\}; & \quad A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + [(A_4 + A_6) c_5 + (A_2 - A_1) c_6] k_x - [(A_6 - A_4) c_5 + (A_1 + A_2) c_6] k_y;
\end{aligned}$$

SG 216

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 $\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{\sigma_{da}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_3; & \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_y^2 - k_x^2) - \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_4; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_5; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; R_5; & \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_1 k_x k_z + c_5 \sigma_3 (k_x^2 - k_z^2); \\
L; R_3; & \quad (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + \sigma_3 [c_4 (q_x^2 - q_y^2) - c_5 q_x q_z] + [\sigma_+ q_y (2c_4 q_x + c_5 q_z) + h.c.]; \\
\Delta; \{R_3, R_4\}; & \quad (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_4 \sigma_3 k_x k_z + [\alpha_1 \sigma_+ (k_x^2 - k_z^2) + h.c.]; \\
\Lambda; R_3; & \quad (c_1 + c_2 q_z) \sigma_0 + c_3 (\sigma_1 q_y - \sigma_3 q_x);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3, R_4\}; & \quad A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_x + [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_z; \\
\{R_2\}, \{R_3, R_4\}; & \quad A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y - [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_x + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
\{R_1\}, \{R_3\}; & \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2\sqrt{2} (A_1 c_6 - A_4 c_4)] q_x + \\
& \quad 2 [\sqrt{3} (A_2 c_6 - A_6 c_4) + A_7 c_5] q_y; \\
\{R_2\}, \{R_3\}; & \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2 (A_2 c_6 - A_6 c_4)] q_x + 2 (A_4 c_4 + A_7 c_5 - A_1 c_6) q_y; \\
\Sigma; \{R_1\}, \{R_2\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
S; \{R_1\}, \{R_2\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z) + c_5 \sigma_2 (k_z - k_x); \\
Z; \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y + c_6 \sigma_1 k_z;
\end{aligned}$$

$\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{\sigma_{da}|000\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_3; & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_y^2 - k_x^2) - \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_4; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_5; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
H; R_3; & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_y^2 - k_x^2) - \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_4; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_5; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
P; R_3; & (c_1 + c_2 q^2) \sigma_0 + c_3 [2\sigma_1 q_y (q_x - \sqrt{2} q_z) + \sigma_3 (2\sqrt{2} q_x q_z + q_x^2 - q_y^2)]; \\
R_4; & c_1 A_0 + c_2 (A_7 k_x + A_6 k_y + A_4 k_z); \\
R_5; & c_1 A_0 + c_2 (A_7 k_x + A_6 k_y + A_4 k_z); \\
\Delta; \{R_3, R_4\}; & (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_4 \sigma_3 k_x k_z + [\alpha_1 \sigma_+ (k_x^2 - k_z^2) + h.c.]; \\
\Lambda; R_3; & (c_1 + c_2 q_z) \sigma_0 + c_3 (\sigma_1 q_y - \sigma_3 q_x); \\
F; R_3; & [c_1 + c_2 (k_x - k_y + k_z)] \sigma_0 + c_3 [\sqrt{3} \sigma_1 (k_x + k_y) + \sigma_3 (k_x - k_y - 2k_z)];
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
& \{R_1\}, \{R_3, R_4\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y - [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_x + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_z; \\
& \{R_2\}, \{R_3, R_4\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_x + [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2\sqrt{2} (A_1 c_6 - A_4 c_4)] q_x + \\
& 2 [\sqrt{3} (A_2 c_6 - A_6 c_4) + A_7 c_5] q_y; \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2 (A_2 c_6 - A_6 c_4)] q_x + 2 (A_4 c_4 + A_7 c_5 - A_1 c_6) q_y; \\
D; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x + k_y); \\
& \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x - k_y); \\
& \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x - k_y); \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + (c_5 \sigma_1 + c_6 \sigma_2) (k_x + k_y); \\
& \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
G; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_2 (k_x + k_y); \\
F; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 p_z) + c_3 \sigma_3 p_z; \\
& \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 p_z) + (\sqrt{3} A_5 + A_8) c_3 p_z + (A_6 c_4 - c_7 A_2 - 2c_5 A_7) (\sqrt{3} p_x - p_y) + \\
& [c_6 A_1 - A_4 c_4 + c_5 (A_5 - \sqrt{3} A_8)] (p_x + \sqrt{3} p_y); \\
& \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 p_z) + (\sqrt{3} A_5 + A_8) c_3 p_z + (A_1 c_6 - A_4 c_4 - 2c_5 A_7) (\sqrt{3} p_x - p_y) + \\
& [c_5 (A_5 - \sqrt{3} A_8) - A_6 c_4 + A_2 c_6] (p_x + \sqrt{3} p_y);
\end{aligned}$$

$\Gamma_c; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{\sigma_{da}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_3; & \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_y^2 - k_x^2) - \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_4; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_5; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; \quad \{R_5, R_6\}; & \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) (k_x^2 - k_z^2); \\
\{R_7, R_8\}; & \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + (c_4 \sigma_1 + c_5 \sigma_2) (k_x^2 - k_z^2); \\
R_9; & \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_3 (k_x^2 - k_z^2) + c_5 \sigma_2 k_y; \\
M; \quad R_5; & \quad (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 \sigma_3 (k_x^2 - k_y^2); \\
R; \quad \{R_3, R_4\}; & \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \sigma_3 k_x k_y k_z; \\
\{R_6, R_6\}; & \quad (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 \left[ \Gamma_{3,1} (k_x^2 - k_y^2) - \frac{\Gamma_{3,2} (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right] + \left\{ \alpha_1 \left[ \Gamma_{+,1} (k_x^2 - k_y^2) - \frac{\Gamma_{+,2} (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right] + h.c. \right\}; \\
\{R_9, R_{10}\}; & \quad c_1 S_{0,0} + c_2 (S_{1,1} k_x + S_{1,2} k_y - S_{1,3} k_z) + c_3 (S_{2,1} k_x + S_{2,2} k_y - S_{2,3} k_z) + c_4 (S_{3,4} k_x - S_{3,6} k_y - S_{3,7} k_z); \\
\Delta; \quad \{R_3, R_4\}; & \quad (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_4 \sigma_3 k_x k_z + [\alpha_1 \sigma_+ (k_x^2 - k_z^2) + h.c.]; \\
\Lambda; \quad R_3; & \quad (c_1 + c_2 q_z) \sigma_0 + c_3 (\sigma_3 q_x - q_y \sigma_1); \\
S; \quad \{R_1, R_2\}; & \quad [c_1 + c_2 (k_x + k_z)] \sigma_0 + c_4 \sigma_3 k_y + (c_3 \sigma_1 + c_5 \sigma_2) (k_x - k_z); \\
T; \quad \{R_1, R_2\}; & \quad (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) \sigma_0 + c_4 \sigma_3 k_x k_y + [\alpha_1 \sigma_+ (k_x^2 - k_y^2) + h.c.];
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_1\}, \{R_3, R_4\}; & \quad A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_x + [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_z; \\
\{R_2\}, \{R_3, R_4\}; & \quad A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y - [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_x + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_z; \\
\Sigma; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\Lambda; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
\{R_1\}, \{R_3\}; & \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2\sqrt{2} (A_1 c_6 - A_4 c_4)] q_x + \\
& \quad 2 [\sqrt{3} (A_2 c_6 - A_6 c_4) + A_7 c_5] q_y; \\
\{R_2\}, \{R_3\}; & \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2 (A_2 c_6 - A_6 c_4)] q_x + 2 (A_4 c_4 + A_7 c_5 - A_1 c_6) q_y; \\
Z; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y + c_6 \sigma_1 k_z; \\
T; \quad \{R_1, R_2\}, \{R_3\}; & \quad A_0 (c_1 + c_2 k_z) + A_8 c_3 k_z + [(A_6 - A_7) c_4 - (A_2 + A_3) c_5] k_x - [(A_6 + A_7) c_4 + (A_3 - A_2) c_5] k_y; \\
\{R_1, R_2\}, \{R_4\}; & \quad A_0 (c_1 + c_2 k_z) + A_8 c_3 k_z + [(A_6 + A_7) c_4 + (A_3 - A_2) c_5] k_x + [(A_6 - A_7) c_4 - (A_2 + A_3) c_5] k_y; \\
\{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z;
\end{aligned}$$

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 $\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2z}|000\}, \{C_{2x}|000\}, \{\sigma_{da}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; without SOC}$ 


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$$\begin{aligned}
\Gamma; \quad R_3; & \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_y^2 - k_x^2) - \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_4; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_5; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; \quad R_5; & \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_1 k_x k_z + c_5 \sigma_3 (k_x^2 - k_z^2); \\
L; \quad \{R_3, R_4\}; & \quad c_2 \sigma_3 q_z + c_1 \sigma_0; \\
& \quad \{R_6, R_6\}; \quad c_1 \Gamma_{0,0} + c_2 (\sqrt{2} \Gamma_{0,3} q_x - \sqrt{2} \Gamma_{0,1} q_y + \Gamma_{3,0} q_z) + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} q_z; \\
W; \quad \{R_1, R_3\}; & \quad c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_x; \\
& \quad \{R_2, R_4\}; \quad c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_x; \\
\Delta; \quad \{R_3, R_4\}; & \quad (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_4 \sigma_3 k_x k_z + [\alpha_1 \sigma_+ (k_x^2 - k_z^2) + h.c.]; \\
\Lambda; \quad R_3; & \quad (c_1 + c_2 q_z) \sigma_0 - c_3 [\sigma_3 q_x - q_y (\sigma_- + \sigma_+)] ; \\
Q; \quad \{R_1, R_1\}; & \quad [c_1 + c_2 (k_y - k_z)] \sigma_0 + \sum_{i=1}^3 \sigma_i [c_{i,1} k_x + c_{i,2} (k_y + k_z)];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

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$$\begin{aligned}
\Delta; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
& \quad \{R_1\}, \{R_3, R_4\}; \quad A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_x + [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_z; \\
& \quad \{R_2\}, \{R_3, R_4\}; \quad A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y - [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_x + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_z; \\
\Lambda; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
& \quad \{R_1\}, \{R_3\}; \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2\sqrt{2} (A_1 c_6 - A_4 c_4)] q_x + \\
& \quad \quad 2 [\sqrt{3} (A_2 c_6 - A_6 c_4) + A_7 c_5] q_y; \\
& \quad \{R_2\}, \{R_3\}; \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2 (A_2 c_6 - A_6 c_4)] q_x + 2 (A_4 c_4 + A_7 c_5 - A_1 c_6) q_y; \\
\Sigma; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
S; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z) + c_5 \sigma_2 (k_z - k_x); \\
Z; \quad \{R_1\}, \{R_2\}; & \quad \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_2 k_y + c_6 \sigma_1 k_z;
\end{aligned}$$

$\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\sigma_{da}|\frac{1}{2}00\}, \mathcal{T};$  Non-Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_3; & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_y^2 - k_x^2) - \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_4; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_5; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
H; \{R_3, R_4\}; & (c_1 + c_2 k^2) \sigma_0 + c_3 \sigma_3 k_x k_y k_z; \\
\{R_6, R_6\}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 \left[ \Gamma_{3,1} (k_x^2 - k_y^2) - \frac{\Gamma_{3,2} (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right] + \left\{ \alpha_1 \left[ \Gamma_{+,1} (k_x^2 - k_y^2) - \frac{\Gamma_{+,2} (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right] + h.c. \right\}; \\
\{R_9, R_{10}\}; & c_1 S_{0,0} + c_2 (S_{1,1} k_x + S_{1,2} k_y - S_{1,3} k_z) + c_3 (S_{2,1} k_x + S_{2,2} k_y - S_{2,3} k_z) + c_4 (S_{3,4} k_x - S_{3,6} k_y - S_{3,7} k_z); \\
P; R_9; & c_1 \sigma_0; \\
R_{10}; & c_1 \sigma_0; \\
R_{16}; & c_1 \Gamma_{0,0} + \sqrt{6} (c_2 - c_3) (\Gamma_{3,1} k_y + \Gamma_{3,2} k_z) + k_x [(3-i)c_2 + 4ic_3] \Gamma_{+,3} + (k_y \Gamma_{+,1} - k_z \Gamma_{+,2}) [(2ic_2 + (3+i)c_3)]; \\
N; R_5; & c_1 \sigma_0 + c_2 \sigma_2 (k_x + k_y); \\
\Delta; \{R_3, R_4\}; & (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_4 \sigma_3 k_x k_z + [\alpha_1 \sigma_+ (k_x^2 - k_z^2) + h.c.]; \\
\Lambda; R_3; & (c_1 + c_2 q_z) \sigma_0 - c_3 [\sigma_3 q_x - q_y (\sigma_- + \sigma_+)]; \\
D; R_5; & (c_1 + c_2 k_z) \sigma_0 + c_2 \sigma_3 (k_x + k_y) + c_3 \sigma_1 (k_x - k_y); \\
G; \{R_1, R_2\}; & [c_1 + c_2 (k_x - k_y)] \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) (k_x + k_y) + c_5 \sigma_3 k_z; \\
F; R_6; & [c_1 + c_2 (k_x - k_y + k_z)] \sigma_0 + c_3 \sigma_1 (k_x + k_y) + \frac{c_3 \sigma_3 (-k_x + k_y + 2k_z)}{\sqrt{3}};
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3, R_4\}; & A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y - [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_x + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_z; \\
\{R_2\}, \{R_3, R_4\}; & A_0 (c_1 + c_2 k_y) + (\sqrt{3} A_5 + A_8) c_3 k_y + [(A_4 + A_6) c_4 + (A_2 - A_1) c_5] k_x + [(A_6 - A_4) c_4 + (A_1 + A_2) c_5] k_z; \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
\{R_1\}, \{R_3\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2\sqrt{2} (A_1 c_6 - A_4 c_4)] q_x + \\
& 2 [\sqrt{3} (A_2 c_6 - A_6 c_4) + A_7 c_5] q_y; \\
\{R_2\}, \{R_3\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + [c_5 (A_5 - \sqrt{3} A_8) + 2 (A_2 c_6 - A_6 c_4)] q_x + 2 (A_4 c_4 + A_7 c_5 - A_1 c_6) q_y; \\
F; \{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 p_z) + c_3 \sigma_3 p_z; \\
\{R_3\}, \{R_6\}; & A_0 (c_1 + c_2 p_z) + (\sqrt{3} A_5 + A_8) c_3 p_z + c_5 [(p_x + \sqrt{3} p_y) (A_5 - \sqrt{3} A_8) + 2 A_7 (\sqrt{3} p_x - p_y)] + \\
& [(A_4 + \sqrt{3} A_6) c_4 - (A_1 + \sqrt{3} A_2) c_6] p_x + [(\sqrt{3} A_4 - A_6) c_4 + (A_2 - \sqrt{3} A_1) c_6] p_y; \\
\{R_4\}, \{R_6\}; & A_0 (c_1 + c_2 p_z) + (\sqrt{3} A_5 + A_8) c_3 p_z + c_5 [(p_x + \sqrt{3} p_y) (A_5 - \sqrt{3} A_8) + 2 A_7 (\sqrt{3} p_x - p_y)] + \\
& [(\sqrt{3} A_4 - A_6) c_4 + (A_2 - \sqrt{3} A_1) c_6] p_x - [(A_4 + \sqrt{3} A_6) c_4 - (A_1 + \sqrt{3} A_2) c_6] p_y
\end{aligned}$$

SG 221

 $\Gamma_c; \{S_{61}^-|000\}, \{\sigma_x|000\}, \{\sigma_z|000\}, \{C_{2c}|000\}, \mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_5; \quad & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_6; \quad & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_7; \quad & (c_1 + c_2 k^2) A_0 + c_3 \left[ \sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2) \right] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_8; \quad & (c_1 + c_2 k^2) A_0 + c_3 \left[ \sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2) \right] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_9; \quad & (c_1 + c_2 k^2) A_0 + c_3 \left[ \sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2) \right] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_{10}; \quad & (c_1 + c_2 k^2) A_0 + c_3 \left[ \sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2) \right] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; \quad R_5; \quad & (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_1 k_x k_z + c_5 \sigma_3 (k_x^2 - k_z^2); \\
R_{10}; \quad & (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_1 k_x k_z + c_5 \sigma_3 (k_x^2 - k_z^2); \\
M; \quad R_5; \quad & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 \sigma_3 (k_x^2 - k_y^2); \\
R_{10}; \quad & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 \sigma_3 (k_x^2 - k_y^2); \\
R; \quad R_5; \quad & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_6; \quad & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_7; \quad & (c_1 + c_2 k^2) A_0 + c_3 \left[ \sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2) \right] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_8; \quad & (c_1 + c_2 k^2) A_0 + c_3 \left[ \sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2) \right] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_9; \quad & (c_1 + c_2 k^2) A_0 + c_3 \left[ \sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2) \right] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_{10}; \quad & (c_1 + c_2 k^2) A_0 + c_3 \left[ \sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2) \right] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\Delta; \quad R_5; \quad & (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_5 \sigma_1 k_x k_z + c_6 \sigma_3 (k_x^2 - k_z^2); \\
\Lambda; \quad R_3; \quad & (c_1 + c_2 q_z) \sigma_0 - c_3 (\sigma_3 q_x - \sigma_1 q_y); \\
T; \quad R_5; \quad & (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3 (k_x^2 - k_y^2);
\end{aligned}$$



$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_1 k_z - A_2 k_x); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_1 k_x + A_2 k_z); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_3\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_2 k_x + A_1 k_z); \\
&\quad \{R_4\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_2 k_z - A_1 k_x); \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
&\quad \{R_1\}, \{R_3\}; A_0(c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4(A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5(A_1 q_x + A_2 q_y); \\
&\quad \{R_2\}, \{R_3\}; A_0(c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4(A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5(A_2 q_x - A_1 q_y); \\
&S; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1(k_x - k_z); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1(k_x - k_z); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z); \\
&Z; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&T; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_5\}; A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4(A_2 k_y - A_1 k_x); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_2\}, \{R_5\}; A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4(A_2 k_x + A_1 k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_3\}, \{R_5\}; A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4(A_1 k_x + A_2 k_y); \\
&\quad \{R_4\}, \{R_5\}; A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4(A_1 k_y - A_2 k_x);
\end{aligned}$$

$\Gamma_c; \{S_{61}^- | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\sigma_x | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\sigma_z | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2c} | 000\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_6; & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_7; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_8; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_9; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_{10}; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
R_{11}; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
\{R_{12}, R_{13}\}; & (c_1 + c_2 k^2 + c_3 k_y^2) \Gamma_{0,0} + [\alpha_1 \Gamma_{+,0} (k_x^2 - k_z^2) + \alpha_2 k_x k_z \Gamma_{+,3} + \alpha_3 k_y \Gamma_{+,2} + h.c.]; \\
M; R_9; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x k_y; \\
R_{11}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R_{12}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x k_y; \\
R_{14}; & c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R; R_7; & (c_1 + c_2 k^2) \sigma_0 + c_3 \sigma_2 k_x k_y k_z; \\
\{R_8, R_9\}; & (c_1 + c_2 k^2) \Gamma_{0,0} + (c_3 \Gamma_{1,0} + c_4 \Gamma_{2,0}) (2k_x^2 - k_y^2 - k_z^2) - \sqrt{3} (c_3 \Gamma_{2,3} - c_4 \Gamma_{1,3}) (k_y^2 - k_z^2); \\
R_{14}; & c_1 S_{0,0} + c_2 (k_x S'_1 + k_y S'_2 + k_z S'_3) + c_3 (k_x S'_4 + k_y S'_5 + k_z S'_6); \\
\Delta; R_5; & (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_5 \sigma_1 k_x k_z + c_6 \sigma_3 (k_x^2 - k_z^2); \\
\Lambda; R_3; & (c_1 + c_2 q_z) \sigma_0 - c_3 (\sigma_3 q_x - \sigma_1 q_y); \\
S; R_5; & [c_1 + c_2 (k_x + k_z)] \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 (k_x - k_z); \\
Z; R_5; & (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 k_z; \\
T; R_9; & (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) \sigma_0 + c_5 \sigma_3 k_x k_y + c_6 \sigma_2 (k_x^2 - k_y^2);
\end{aligned}$$

Here,  $S'_1 = 3S_{0,1} - 2S_{2,0} + 2\sqrt{3}S_{2,8} - 3S_{3,1}$ ,  $S'_2 = 3(-S_{1,1} + S_{1,2} + S_{2,4} + S_{2,6})$ ,  $S'_3 = 3(S_{0,3} - S_{1,1} - S_{2,4} + S_{3,3})$ ,  
 $S'_4 = 3(-S_{0,3} + S_{1,2} - S_{2,6} + S_{3,3})$ ,  $S'_5 = -(3S_{1,3} + 2S_{2,0} + 3S_{2,5} + 3S_{2,7} + \sqrt{3}S_{2,8})$ ,  $S'_6 = (3S_{0,2} - 2S_{2,0} + 3S_{2,5} - \sqrt{3}S_{2,8} + 3S_{3,2})$ .

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_1 k_z - A_2 k_x); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_1 k_x + A_2 k_z); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_3\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_2 k_x + A_1 k_z); \\
&\quad \{R_4\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_2 k_z - A_1 k_x); \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
&\quad \{R_1\}, \{R_3\}; A_0(c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4(A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5(A_1 q_x + A_2 q_y); \\
&\quad \{R_2\}, \{R_3\}; A_0(c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4(A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5(A_2 q_x - A_1 q_y); \\
&T; \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_5\}, \{R_9\}; A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4[(A_1 - A_2 - A_4 - A_6) k_y - (A_1 + A_2 - A_4 + A_6) k_x]; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_6\}, \{R_9\}; A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4[(-A_1 + A_2 + A_4 + A_6) k_x + (A_1 + A_2 - A_4 + A_6) k_y]; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_7\}, \{R_9\}; A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4[(-A_1 + A_2 + A_4 + A_6) k_y - (A_1 + A_2 - A_4 + A_6) k_x]; \\
&\quad \{R_8\}, \{R_9\}; A_0(c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4[(-A_1 + A_2 + A_4 + A_6) k_x - (A_1 + A_2 - A_4 + A_6) k_y];
\end{aligned}$$

$\Gamma_c; \{S_{61}^-|000\}, \{\sigma_x|000\}, \{\sigma_z|000\}, \{C_{2c}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_6; & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_7; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_8; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_9; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_{10}; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; R_9; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
R_{11}; & (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_3 (k_x^2 - k_z^2); \\
R_{12}; & c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
R_{14}; & (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_3 (k_x^2 - k_z^2); \\
M; R_5; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 \sigma_3 (k_x^2 - k_y^2); \\
R_{10}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_1 k_x k_y + c_5 \sigma_3 (k_x^2 - k_y^2); \\
R; R_7; & (c_1 + c_2 k^2) \sigma_0 + c_3 \sigma_2 k_x k_y k_z; \\
\{R_8, R_9\}; & (c_1 + c_2 k^2) \Gamma_{0,0} + (c_3 \Gamma_{1,0} + c_4 \Gamma_{2,0}) (2k_x^2 - k_y^2 - k_z^2) - \sqrt{3} (c_3 \Gamma_{2,3} - c_4 \Gamma_{1,3}) (k_y^2 - k_z^2); \\
R_{14}; & c_1 S_{0,0} + c_2 (k_x S'_1 + k_y S'_2 + k_z S'_3) + c_3 (k_x S'_4 + k_y S'_5 + k_z S'_6); \\
\Delta; R_5; & (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_5 \sigma_1 k_x k_z + c_6 \sigma_3 (k_x^2 - k_z^2); \\
\Lambda; R_3; & (c_1 + c_2 q_z) \sigma_0 + c_3 (\sigma_3 q_x - \sigma_1 q_y); \\
S; R_5; & [c_1 + c_2 (k_x + k_z)] \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 (k_x - k_z); \\
T; R_{10}; & (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) \sigma_0 + c_5 \sigma_1 k_x k_y + c_6 \sigma_3 (k_x^2 - k_y^2);
\end{aligned}$$

Definition of  $S'_i$ , see SG 222.

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_5\}; & A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_1 k_z - A_2 k_x); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_2\}, \{R_5\}; & A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_1 k_x + A_2 k_z); \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_3\}, \{R_5\}; & A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_2 k_x + A_1 k_z); \\
\{R_4\}, \{R_5\}; & A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_2 k_z - A_1 k_x); \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
\{R_1\}, \{R_3\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4 (A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5 (A_1 q_x + A_2 q_y); \\
\{R_2\}, \{R_3\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4 (A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5 (A_2 q_x - A_1 q_y); \\
Z; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
T; \{R_6\}, \{R_{10}\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_2 k_x + A_1 k_y); \\
\{R_6\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_6\}, \{R_9\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_7\}, \{R_{10}\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_2 k_y - A_1 k_x); \\
\{R_7\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_7\}, \{R_9\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_8\}, \{R_{10}\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_1 k_y - A_2 k_x); \\
\{R_8\}, \{R_9\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_9\}, \{R_{10}\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 (A_1 k_x + A_2 k_y);
\end{aligned}$$

$\Gamma_c; \{S_{61}^- | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\sigma_x | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\sigma_z | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2c} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad & R_5; \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
& R_6; \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
& R_7; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
& R_8; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
& R_9; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
& R_{10}; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; \quad & R_9; \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_3 k_x k_z; \\
& R_{11}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
& R_{12}; \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_3 k_x k_z; \\
& R_{14}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
M; \quad & R_9; \quad (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x k_y; \\
& R_{11}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
& R_{12}; \quad (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x k_y; \\
& R_{14}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_z; \\
R; \quad & R_5; \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
& R_6; \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
& R_7; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
& R_8; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
& R_9; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
& R_{10}; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
\Delta; \quad & R_5; \quad (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_5 \sigma_1 k_x k_z + c_6 \sigma_3 (k_x^2 - k_z^2); \\
\Lambda; \quad & R_3; \quad (c_1 + c_2 q_z) \sigma_0 - c_3 (\sigma_3 q_x - \sigma_1 q_y); \\
Z; \quad & R_5; \quad (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_1 k_y + c_4 \sigma_2 k_z; \\
T; \quad & R_{10}; \quad (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) \sigma_0 + c_5 \sigma_3 k_x k_y + c_6 \sigma_2 (k_x^2 - k_y^2);
\end{aligned}$$

$$\begin{aligned}
\Delta; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_1\}, \{R_5\}; & A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_1 k_z - A_2 k_x); \\
\{R_2\}, \{R_3\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_2\}, \{R_5\}; & A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_1 k_x + A_2 k_z); \\
\{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
\{R_3\}, \{R_5\}; & A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_2 k_x + A_1 k_z); \\
\{R_4\}, \{R_5\}; & A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_2 k_z - A_1 k_x); \\
\Sigma; \{R_1\}, \{R_2\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\{R_1\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_1\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_3\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
\{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
\{R_3\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
\Lambda; \{R_1\}, \{R_2\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
\{R_1\}, \{R_3\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4 (A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5 (A_1 q_x + A_2 q_y); \\
\{R_2\}, \{R_3\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4 (A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5 (A_2 q_x - A_1 q_y); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z) + c_5 \sigma_1 k_y; \\
\{R_2\}, \{R_6\}; & \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z); \\
\{R_2\}, \{R_8\}; & \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z) + c_5 \sigma_1 (k_x - k_z); \\
\{R_4\}, \{R_6\}; & \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z) + c_5 \sigma_1 (k_x - k_z); \\
\{R_4\}, \{R_8\}; & \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z); \\
\{R_6\}, \{R_8\}; & \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z) + c_5 \sigma_1 k_y; \\
T; \{R_5\}, \{R_{10}\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 [(-A_1 + A_2 + A_4 + A_6) k_y - (A_1 + A_2 - A_4 + A_6) k_x]; \\
\{R_5\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_5\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_6\}, \{R_{10}\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 [(-A_1 + A_2 + A_4 + A_6) k_x - (A_1 + A_2 - A_4 + A_6) k_y]; \\
\{R_6\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_7\}, \{R_{10}\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 [(-A_1 + A_2 + A_4 + A_6) k_x + (A_1 + A_2 - A_4 + A_6) k_y]; \\
\{R_7\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
\{R_8\}, \{R_{10}\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + c_4 [(A_1 - A_2 - A_4 - A_6) k_y - (A_1 + A_2 - A_4 + A_6) k_x];
\end{aligned}$$

$\Gamma_c^f$ ;  $\{S_{61}^-|000\}$ ,  $\{\sigma_x|000\}$ ,  $\{\sigma_z|000\}$ ,  $\{C_{2c}|000\}$ ,  $\mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_5; \quad & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_6; \quad & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_7; \quad & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_8; \quad & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_9; \quad & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_{10}; \quad & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; \quad R_5; \quad & (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_1 k_x k_z + c_5 \sigma_3 (k_x^2 - k_z^2); \\
R_{10}; \quad & (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_1 k_x k_z + c_5 \sigma_3 (k_x^2 - k_z^2); \\
L; \quad R_5; \quad & (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + \sigma_1 q_y (2c_4 q_x + c_5 q_z) - \sigma_3 (c_4 q_x^2 - c_4 q_y^2 - c_5 q_x q_z); \\
R_6; \quad & (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + \sigma_1 q_y (2c_4 q_x + c_5 q_z) + \sigma_3 (c_4 q_x^2 - c_4 q_y^2 - c_5 q_x q_z); \\
W; \quad R_5; \quad & c_1 \sigma_0 + c_2 \sigma_1 k_x; \\
\Delta; \quad R_5; \quad & (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_5 \sigma_1 k_x k_z + c_6 \sigma_3 (k_x^2 - k_z^2); \\
\Lambda; \quad R_3; \quad & (c_1 + c_2 q_z) \sigma_0 - c_3 (\sigma_3 q_x - \sigma_1 q_y);
\end{aligned}$$



$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_1 k_z - A_2 k_x); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_1 k_x + A_2 k_z); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_3\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_2 k_x + A_1 k_z); \\
&\quad \{R_4\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_2 k_z - A_1 k_x); \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
&\quad \{R_1\}, \{R_3\}; A_0(c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4(A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5(A_1 q_x + A_2 q_y); \\
&\quad \{R_2\}, \{R_3\}; A_0(c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4(A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5(A_2 q_x - A_1 q_y); \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&S; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1(k_x - k_z); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1(k_x - k_z); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z); \\
&Z; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&Q; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_y - k_z)] + \sigma_3 c_3(k_y - k_z) + \sigma_1[c_4 k_x + c_5(k_y + k_z)];
\end{aligned}$$

$\Gamma_c^f$ ;  $\{S_{61}^-|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}$ ,  $\{\sigma_x|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}$ ,  $\{\sigma_z|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}$ ,  $\{C_{2c}|000\}$ ,  $\mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_5; & \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_6; & \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_7; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_8; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_9; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_{10}; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; \quad R_5; & \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_1 k_x k_z + c_5 \sigma_3 (k_x^2 - k_z^2); \\
R_{10}; & \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_1 k_x k_z + c_5 \sigma_3 (k_x^2 - k_z^2); \\
L; \quad \{R_7, R_8\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} q_x + \Gamma_{0,2} q_y) + q_z (c_3 \Gamma_{1,2} + c_4 \Gamma_{2,2}); \\
R_9; & \quad c_1 \sigma_0 + c_2 \sigma_1 q_z; \\
W; \quad \{R_{13}, R_{16}\}; & \quad c_1 \sigma_0 + (c_2 \sigma_1 - c_3 \sigma_2) k_x; \\
\{R_{14}, R_{15}\}; & \quad c_1 \sigma_0 + (c_2 \sigma_1 - c_3 \sigma_2) k_x; \\
R_{20}; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_x; \\
\Delta; \quad R_5; & \quad (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_5 \sigma_1 k_x k_z + c_6 \sigma_3 (k_x^2 - k_z^2); \\
\Lambda; \quad R_3; & \quad (c_1 + c_2 q_z) \sigma_0 - c_3 (\sigma_3 q_x - \sigma_1 q_y); \\
Q; \quad \{R_1, R_2\}; & \quad [c_1 + c_2 (k_y - k_z)] \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_x + (c_5 \sigma_1 + c_6 \sigma_2) (k_y + k_z);
\end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_1 k_z - A_2 k_x); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_1 k_x + A_2 k_z); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_3\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_2 k_x + A_1 k_z); \\
&\quad \{R_4\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_2 k_z - A_1 k_x); \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
&\quad \{R_1\}, \{R_3\}; A_0(c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4(A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5(A_1 q_x + A_2 q_y); \\
&\quad \{R_2\}, \{R_3\}; A_0(c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4(A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5(A_2 q_x - A_1 q_y); \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&S; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1(k_x - k_z); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1(k_x - k_z); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z); \\
&Z; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x + c_5 \sigma_1 k_y; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + c_3 \sigma_3 k_x;
\end{aligned}$$

$\Gamma_c^f$ ;  $\{S_{61}^-|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}$ ,  $\{\sigma_x|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}$ ,  $\{\sigma_z|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}$ ,  $\{C_{2c}|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}$ ,  $\mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad & R_5; \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
& R_6; \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
& R_7; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
& R_8; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
& R_9; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
& R_{10}; \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; \quad & R_{10}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
& R_{11}; \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_3 k_x k_z; \\
& R_{13}; \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
& R_{14}; \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_3 k_x k_z; \\
L; \quad & R_5; \quad (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + \sigma_1 q_y (2c_4 q_x + c_5 q_z) - \sigma_3 (c_4 q_x^2 - c_4 q_y^2 - c_5 q_x q_z); \\
& R_6; \quad (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + \sigma_1 q_y (2c_4 q_x + c_5 q_z) + \sigma_3 (c_4 q_x^2 - c_4 q_y^2 - c_5 q_x q_z); \\
W; \quad & R_{11}; \quad c_1 \sigma_0 + c_2 [(\sigma_1 - \sigma_2) k_y - (\sigma_1 + \sigma_2) k_z]; \\
& R_{12}; \quad c_1 \sigma_0 + c_2 [(\sigma_1 + \sigma_2) k_y + (\sigma_2 - \sigma_1) k_z]; \\
\Delta; \quad & R_5; \quad (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_5 \sigma_1 k_x k_z + c_6 \sigma_3 (k_x^2 - k_z^2); \\
\Lambda; \quad & R_3; \quad (c_1 + c_2 q_z) \sigma_0 - c_3 (\sigma_3 q_x - \sigma_1 q_y); \\
Z; \quad & R_5; \quad (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_3 k_y + c_4 \sigma_2 k_z;
\end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_1 k_z - A_2 k_x); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_1 k_x + A_2 k_z); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_3\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_2 k_x + A_1 k_z); \\
&\quad \{R_4\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_2 k_z - A_1 k_x); \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
&\quad \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4 (A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5 (A_1 q_x + A_2 q_y); \\
&\quad \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4 (A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5 (A_2 q_x - A_1 q_y); \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&S; \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z) + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z) + c_5 \sigma_1 (k_x - k_z); \\
&\quad \{R_2\}, \{R_8\}; \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z); \\
&\quad \{R_4\}, \{R_8\}; \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z) + c_5 \sigma_1 (k_x - k_z); \\
&\quad \{R_6\}, \{R_8\}; \sigma_0 [c_1 + c_2 (k_x + k_z)] + c_3 \sigma_3 (k_x + k_z) + c_5 \sigma_1 k_y; \\
&Q; \{R_4\}, \{R_8\}; \sigma_0 [c_1 + c_2 (k_y - k_z)] + \sigma_3 c_3 (k_y - k_z) + \sigma_1 [c_4 k_x + c_5 (k_y + k_z)];
\end{aligned}$$

$\Gamma_c^f$ ;  $\{S_{61}^-|\frac{3}{4}\frac{3}{4}\frac{3}{4}\}$ ,  $\{\sigma_x|\frac{3}{4}\frac{3}{4}\frac{3}{4}\}$ ,  $\{\sigma_z|\frac{3}{4}\frac{3}{4}\frac{3}{4}\}$ ,  $\{C_{2c}|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}$ ,  $\mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; \quad R_5; & \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_6; & \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_7; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_8; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_9; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_{10}; & \quad (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
X; \quad R_9; & \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_3 k_x k_z; \\
R_{11}; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
R_{12}; & \quad (c_1 + c_2 k^2 + c_3 k_y^2) \sigma_0 + c_4 \sigma_3 k_x k_z; \\
R_{14}; & \quad c_1 \sigma_0 + c_2 \sigma_2 k_y; \\
L; \quad \{R_7, R_8\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} q_x + \Gamma_{0,2} q_y) + q_z (c_3 \Gamma_{1,2} + c_4 \Gamma_{2,2}); \\
R_9; & \quad c_1 \sigma_0 + c_2 \sigma_1 q_z; \\
W; \quad \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} + c_3 \Gamma_{0,1} (k_y + k_z) - c_3 \Gamma_{3,2} (k_y - k_z) + [\alpha_1 k_x \Gamma_{+,1} - i \alpha_2 \Gamma_{+,0} (k_y - k_z) + \alpha_2 \Gamma_{+,3} (k_y + k_z) + h.c.]; \\
\Delta; \quad R_5; & \quad (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_5 \sigma_1 k_x k_z + c_6 \sigma_3 (k_x^2 - k_z^2); \\
\Lambda; \quad R_3; & \quad (c_1 + c_2 q_z) \sigma_0 - c_3 (\sigma_3 q_x - \sigma_1 q_y); \\
Z; \quad R_5; & \quad (c_1 + c_2 k_x) \sigma_0 + c_3 \sigma_3 k_y + c_4 \sigma_2 k_z; \\
Q; \quad \{R_4, R_8\}; & \quad [c_1 + c_2 (k_y - k_z)] \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_x + (c_5 \sigma_1 + c_6 \sigma_2) (k_y + k_z);
\end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_1 k_z - A_2 k_x); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_1 k_x + A_2 k_z); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_3\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_2 k_x + A_1 k_z); \\
&\quad \{R_4\}, \{R_5\}; A_0(c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4(A_2 k_z - A_1 k_x); \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0(c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
&\quad \{R_1\}, \{R_3\}; A_0(c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4(A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5(A_1 q_x + A_2 q_y); \\
&\quad \{R_2\}, \{R_3\}; A_0(c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4(A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5(A_2 q_x - A_1 q_y); \\
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y) + c_5 \sigma_1(k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_y)] + c_3 \sigma_3(k_x + k_y); \\
&S; \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1 k_y; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1(k_x - k_z); \\
&\quad \{R_2\}, \{R_8\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z); \\
&\quad \{R_4\}, \{R_8\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1(k_x - k_z); \\
&\quad \{R_6\}, \{R_8\}; \sigma_0[c_1 + c_2(k_x + k_z)] + c_3 \sigma_3(k_x + k_z) + c_5 \sigma_1 k_y;
\end{aligned}$$

$\Gamma_c^v$ ;  $\{S_{61}^-|000\}$ ,  $\{\sigma_x|000\}$ ,  $\{\sigma_z|000\}$ ,  $\{C_{2c}|000\}$ ,  $\mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
&\Gamma; R_5; (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
&R_6; (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
&R_7; (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&R_8; (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&R_9; (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&R_{10}; (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&H; R_5; (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
&R_6; (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
&R_7; (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&R_8; (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&R_9; (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&R_{10}; (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
&P; R_3; (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
&R_4; c_1 A_0 + c_2 (A_7 k_x + A_6 k_y + A_4 k_z); \\
&R_5; c_1 A_0 + c_2 (A_7 k_x + A_6 k_y + A_4 k_z); \\
&\Delta; R_5; (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_5 \sigma_1 k_x k_z + c_6 \sigma_3 (k_x^2 - k_z^2); \\
&\Lambda; R_3; (c_1 + c_2 q_z) \sigma_0 - c_3 (\sigma_3 q_x - \sigma_1 q_y); \\
&F; R_3; [c_1 + c_2 (k_x - k_y + k_z)] \sigma_0 + c_3 \sigma_1 (k_x + k_y) + \frac{c_3 \sigma_3 (k_x - k_y - 2k_z)}{\sqrt{3}};
\end{aligned}$$



$$\begin{aligned}
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_1\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_1 k_z - A_2 k_x); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_2\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_1 k_x + A_2 k_z); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\quad \{R_3\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_2 k_x + A_1 k_z); \\
&\quad \{R_4\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_2 k_z - A_1 k_x); \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
&\quad \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4 (A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5 (A_1 q_x + A_2 q_y); \\
&\quad \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4 (A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5 (A_2 q_x - A_1 q_y); \\
&D; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x + k_y); \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x - k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x - k_y); \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z + c_5 \sigma_1 (k_x + k_y); \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + c_3 \sigma_3 k_z; \\
&G; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y); \\
&\quad \{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 (k_x + k_y); \\
&\quad \{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 (k_x + k_y); \\
&\quad \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y) + c_5 \sigma_1 k_z; \\
&\quad \{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - k_y)] + \sigma_3 c_3 (k_x - k_y); \\
&F; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 p_z) + c_3 \sigma_3 p_z; \\
&\quad \{R_1\}, \{R_3\}; A_0 (c_1 + c_2 p_z) + (\sqrt{3}A_5 + A_8) (c_3 + c_4 p_z) + c_5 [(A_5 - \sqrt{3}A_8) (p_x + \sqrt{3}p_y) + 2A_7 (p_y - \sqrt{3}p_x)] + \\
&\quad \quad c_6 [(A_1 - \sqrt{3}A_2) p_x + (\sqrt{3}A_1 + A_2) p_y]; \\
&\quad \{R_2\}, \{R_3\}; A_0 (c_1 + c_2 p_z) + (\sqrt{3}A_5 + A_8) (c_3 + c_4 p_z) + c_5 [(A_5 - \sqrt{3}A_8) (p_x + \sqrt{3}p_y) + 2A_7 (p_y - \sqrt{3}p_x)] + \\
&\quad \quad c_6 [A_2 (p_x + \sqrt{3}p_y) + A_1 (\sqrt{3}p_x - p_y)];
\end{aligned}$$

$\Gamma_c^v$ ;  $\{S_{61}^-|000\}$ ,  $\{\sigma_x|\frac{1}{2}\frac{1}{2}0\}$ ,  $\{\sigma_z|\frac{1}{2}0\frac{1}{2}\}$ ,  $\{C_{2c}|00\frac{1}{2}\}$ ,  $\mathcal{T}$ ; Centrosymmetric; without SOC

$$\begin{aligned}
\Gamma; R_5; & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_6; & (c_1 + c_2 k^2) \sigma_0 + c_3 \left[ \sigma_1 (k_x^2 - k_y^2) + \frac{\sigma_3 (k_x^2 + k_y^2 - 2k_z^2)}{\sqrt{3}} \right]; \\
R_7; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_8; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_9; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
R_{10}; & (c_1 + c_2 k^2) A_0 + c_3 [\sqrt{3} A_5 (k_x^2 - k_y^2) + A_8 (k_x^2 + k_y^2 - 2k_z^2)] + c_4 (A_4 k_x k_y + A_6 k_x k_z + A_7 k_y k_z); \\
H; R_7; & c_1 \sigma_0 + c_2 \sigma_1 (k_x^2 - k_y^2) (k_x^2 - k_z^2) (k_y^2 - k_z^2); \\
\{R_8, R_9\}; & (c_1 + c_2 q^2) \Gamma_{0,0} + [i\alpha_1 \Gamma_{+,0} (q_x^2 - q_y^2 + 2\sqrt{2} q_x q_z) + 2\alpha_1 q_y \Gamma_{+,3} (q_x - \sqrt{2} q_z) + h.c.]; \\
R_{14}; & c_1 S_{0,0} + c_2 (S_{2,3} k_x + S_{2,1} k_y + S_{2,2} k_z) + c_3 (S_{3,7} k_x + S_{3,4} k_y - S_{3,6} k_z); \\
P; \{R_9, R_{10}\}; & c_1 \Gamma_{0,0} + [\alpha_1 (q'_x \Gamma_{+,0} - i q'_y \Gamma_{+,3} + i q'_z \Gamma_{+,1}) + h.c.]; \\
R_{16}; & c_1 \Gamma_{0,0} + (c_2 - c_3) (\Gamma_{3,2} k_z + \Gamma_{3,1} k_y) + \{[2ic_2 + (3+i)c_3] (k_y \Gamma_{+,1} - k_z \Gamma_{+,2}) + [(3-i)c_2 + 4ic_3] k_x \Gamma_{+,3} + h.c.\}; \\
N; R_5; & c_1 \sigma_0 + c_2 \sigma_2 (k_x + k_y); \\
R_{10}; & c_1 \sigma_0 + c_2 \sigma_2 (k_x + k_y); \\
\Delta; R_5; & (c_1 + c_2 k_y + c_3 k^2 + c_4 k_y^2) \sigma_0 + c_5 \sigma_1 k_x k_z + c_6 \sigma_3 (k_x^2 - k_z^2); \\
\Lambda; R_3; & (c_1 + c_2 q_z) \sigma_0 - c_3 (\sigma_3 q_x - \sigma_1 q_y); \\
D; R_5; & (c_1 + c_2 k_z) \sigma_0 + c_3 \sigma_1 (k_x - k_y) + c_4 \sigma_3 (k_x + k_y); \\
G; R_5; & [c_1 + c_2 (k_x - k_y)] \sigma_0 + c_3 \sigma_1 (k_x + k_y) + c_4 \sigma_3 k_z; \\
F; R_6; & [c_1 + c_2 (k_x - k_y + k_z)] \sigma_0 + c_3 \sigma_1 (k_x + k_y) - \frac{c_3 \sigma_3 (k_x - k_y - 2k_z)}{\sqrt{3}};
\end{aligned}$$

Here,  $\{q'_x, q'_y, q'_z\} = \{(1 + \sqrt{3}) k_x - 2k_y + (\sqrt{3} - 1) k_z, (1 - \sqrt{3}) k_x - 2k_y - (1 + \sqrt{3}) k_z, -2k_x - 2k_y + 2k_z\}$ .

$$\begin{aligned}
&\Sigma; \{R_1\}, \{R_2\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&\{R_1\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\{R_1\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
&\{R_2\}, \{R_3\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 k_z; \\
&\{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y) + c_5 \sigma_1 (k_x - k_y); \\
&\{R_3\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + k_y)] + c_3 \sigma_3 (k_x + k_y); \\
&\Delta; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\{R_1\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\{R_1\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\{R_1\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_1 k_z - A_2 k_x); \\
&\{R_2\}, \{R_3\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\{R_2\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_1 k_x + A_2 k_z); \\
&\{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + c_3 \sigma_3 k_y; \\
&\{R_3\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_2 k_x + A_1 k_z); \\
&\{R_4\}, \{R_5\}; A_0 (c_1 + c_2 k_y) + (\sqrt{3}A_5 + A_8) c_3 k_y + c_4 (A_2 k_z - A_1 k_x); \\
&\Lambda; \{R_1\}, \{R_2\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
&\{R_1\}, \{R_3\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4 (A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5 (A_1 q_x + A_2 q_y); \\
&\{R_2\}, \{R_3\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3}A_5 + A_8) c_3 q_z + c_4 (A_5 q_x - \sqrt{3}A_8 q_x + 2A_7 q_y) + c_5 (A_2 q_x - A_1 q_y); \\
&F; \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 p_z) + c_3 \sigma_3 p_z; \\
&\{R_3\}, \{R_6\}; A_0 (c_1 + c_2 p_z) + (\sqrt{3}A_5 + A_8) (c_3 p_z) + c_4 [(A_5 - \sqrt{3}A_8) (p_x + \sqrt{3}p_y) + 2A_7 (\sqrt{3}p_x - p_y)] + \\
&\quad c_5 [(A_1 + \sqrt{3}A_2) p_x + (\sqrt{3}A_1 - A_2) p_y] \\
&\{R_4\}, \{R_6\}; A_0 (c_1 + c_2 p_z) + (\sqrt{3}A_5 + A_8) (c_3 + c_4 p_z) + c_5 [(A_5 - \sqrt{3}A_8) (p_x + \sqrt{3}p_y) + 2A_7 (\sqrt{3}p_x - p_y)] + \\
&\quad c_6 [A_2 (p_x + \sqrt{3}p_y) + A_1 (p_y - \sqrt{3}p_x)]
\end{aligned}$$

## S8. ENCYCLOPEDIA OF EMERGENT PARTICLES IN 3D CRYSTALS WITH SOC EFFECT

### A. The double-valued corepresentations of the 230 type-II MSGs and the essential degeneracies

#### 1. Notes to Sec. S8 A

(i) For each table in Sec. S8 A, the first two lines present the SG number, the BZ type, the generating elements of the type II MSG (translations are not included here), whether centrosymmetry is contained in the group and whether SOC is considered.

(ii) Below the first two lines, the columns from left to right (separated by the semicolons) are the high-symmetry momentum  $\mathbf{k}$ , the location of  $\mathbf{k}$  [with respect to reciprocal vectors  $(\mathbf{g}_1, \mathbf{g}_2, \mathbf{g}_3)$ ], the generating elements of the little group at  $\mathbf{k}$  (only point-group operators are presented and a full expression of each generating element can be found in Ref. [9] and in Sec. S5), the deduced corep of the little group at  $\mathbf{k}$ , the dimension of the corep, the matrix representations of the generating elements, the species and the topological charge of the essential degeneracy.

(iii) A correspondence between the notation of the corep used here ( $R_i$ ) and the band-representation notations can be found in Refs. [9, 10]. Moreover, Ref. [10] has established a SpaceGroupIrep package to analyze the band representation based on the notation of Ref. [9].

#### 2. SG 1-10

## SG 1

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 $\Gamma_t; \{\bar{E}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000); \bar{E}, \mathcal{T}; \{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2; \text{C-1 WP}; 1$   
 $B; (\frac{1}{2}00); \bar{E}, \mathcal{T}; \{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2; \text{C-1 WP}; 1$   
 $F; (0\frac{1}{2}0); \bar{E}, \mathcal{T}; \{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2; \text{C-1 WP}; 1$   
 $G; (00\frac{1}{2}); \bar{E}, \mathcal{T}; \{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2; \text{C-1 WP}; 1$

## SG 2

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 $\Gamma_t; \{I|000\}, \{\bar{E}|000\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$\Gamma; (000); I, \bar{E}, \mathcal{T}; \{R_2, R_2\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$   
 $B; (\frac{1}{2}00); I, \bar{E}, \mathcal{T}; \{R_2, R_2\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$   
 $F; (0\frac{1}{2}0); I, \bar{E}, \mathcal{T}; \{R_2, R_2\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$   
 $G; (00\frac{1}{2}); I, \bar{E}, \mathcal{T}; \{R_2, R_2\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$

## SG 3

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 $\Gamma_m; \{C_{2z}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000); C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2; \text{C-1 WP}; 1$   
 $B; (\frac{1}{2}00); C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2; \text{C-1 WP}; 1$   
 $Y; (0\frac{1}{2}0); C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2; \text{C-1 WP}; 1$   
 $Z; (00\frac{1}{2}); C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2; \text{C-1 WP}; 1$   
 $C; (0\frac{1}{2}\frac{1}{2}); C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2; \text{C-1 WP}; 1$   
 $D; (\frac{1}{2}0\frac{1}{2}); C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2; \text{C-1 WP}; 1$   
 $A; (\frac{1}{2}\frac{1}{2}0); C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2; \text{C-1 WP}; 1$   
 $E; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2z}, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2; \text{C-1 WP}; 1$   
 $\Lambda; \Gamma Z; C_{2z}; R_2; 1; i;$   
 $R_4; 1; -i;$   
 $V; \text{BD}; C_{2z}; R_2; 1; i;$   
 $R_4; 1; -i;$   
 $W; \text{YC}; C_{2z}; R_2; 1; i;$   
 $R_4; 1; -i;$   
 $U; \text{AE}; C_{2z}; R_2; 1; i;$   
 $R_4; 1; -i;$

## SG 4

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 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; (000);	$C_{2z}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$B$ ; ( $\frac{1}{2}\bar{1}00$ );	$C_{2z}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$Y$ ; ( $0\frac{1}{2}0$ );	$C_{2z}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$Z$ ; ( $00\frac{1}{2}$ );	$C_{2z}, \bar{E}, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2; $\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-NS <sub>ZCDE</sub> ;	
		$\{R_7, R_7\}$ ;	2; $-\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-NS <sub>ZCDE</sub> ;	
$C$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, \bar{E}, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2; $\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-NS <sub>ZCDE</sub> ;	
		$\{R_7, R_7\}$ ;	2; $-\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-NS <sub>ZCDE</sub> ;	
$D$ ; ( $\frac{1}{2}0\frac{1}{2}$ );	$C_{2z}, \bar{E}, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2; $\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-NS <sub>ZCDE</sub> ;	
		$\{R_7, R_7\}$ ;	2; $-\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-NS <sub>ZCDE</sub> ;	
$A$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$C_{2z}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$E$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, \bar{E}, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2; $\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-NS <sub>ZCDE</sub> ;	
		$\{R_7, R_7\}$ ;	2; $-\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-NS <sub>ZCDE</sub> ;	
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}$ ;	$R_2$ ;	1; $i$ ;		
		$R_4$ ;	1; $-i$ ;		
$V$ ; BD;	$C_{2z}$ ;	$R_2$ ;	1; $i$ ;		
		$R_4$ ;	1; $-i$ ;		
$W$ ; YC;	$C_{2z}$ ;	$R_2$ ;	1; $i$ ;		
		$R_4$ ;	1; $-i$ ;		
$U$ ; AE;	$C_{2z}$ ;	$R_2$ ;	1; $i$ ;		
		$R_4$ ;	1; $-i$ ;		

## SG 5

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 $\Gamma_m^b; \{C_{2z}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; (000);	$C_{2z}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$A$ ; ( $\frac{1}{2}\bar{1}00$ );	$C_{2z}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$Z$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$M$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$L$ ; ( $\frac{1}{2}0\frac{1}{2}$ );	$\bar{E}, \mathcal{T}$ ;	$\{R_2, R_2\}$ ;	2; $-\sigma_0, -i\sigma_2$ ;	C-1 WP;	1
$V$ ; ( $00\frac{1}{2}$ );	$\bar{E}, \mathcal{T}$ ;	$\{R_2, R_2\}$ ;	2; $-\sigma_0, -i\sigma_2$ ;	C-1 WP;	1
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}$ ;	$R_2$ ;	1; $i$ ;		
		$R_4$ ;	1; $-i$ ;		
$U$ ; AM;	$C_{2z}$ ;	$R_2$ ;	1; $i$ ;		
		$R_4$ ;	1; $-i$ ;		

## SG 6

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 $\Gamma_m; \{\sigma_z|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; (000);	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$B$ ; ( $\frac{1}{2}00$ );	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$Y$ ; ( $0\frac{1}{2}0$ );	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$Z$ ; ( $00\frac{1}{2}$ );	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$C$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$D$ ; ( $\frac{1}{2}0\frac{1}{2}$ );	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$A$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$E$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ;	$\bar{E}, \mathcal{T}\sigma_z$ ;	$R_2$ ;	1;	-1, 1;	
$V$ ; BD;	$\bar{E}, \mathcal{T}\sigma_z$ ;	$R_2$ ;	1;	-1, 1;	
$W$ ; YC;	$\bar{E}, \mathcal{T}\sigma_z$ ;	$R_2$ ;	1;	-1, 1;	
$U$ ; AE;	$\bar{E}, \mathcal{T}\sigma_z$ ;	$R_2$ ;	1;	-1, 1;	

## SG 7

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 $\Gamma_m; \{\sigma_z|\frac{1}{2}00\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; (000);	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$B$ ; ( $\frac{1}{2}00$ );	$\sigma_z, \bar{E}, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2;	$\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL <sub>BD</sub> ;
		$\{R_7, R_7\}$ ;	2;	$-\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL <sub>BD</sub> ;
$Y$ ; ( $0\frac{1}{2}0$ );	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$Z$ ; ( $00\frac{1}{2}$ );	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$C$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$D$ ; ( $\frac{1}{2}0\frac{1}{2}$ );	$\sigma_z, \bar{E}, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2;	$\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL <sub>BD</sub> ;
		$\{R_7, R_7\}$ ;	2;	$-\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL <sub>BD</sub> ;
$A$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$\sigma_z, \bar{E}, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2;	$\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL <sub>AE</sub> ;
		$\{R_7, R_7\}$ ;	2;	$-\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL <sub>AE</sub> ;
$E$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, \bar{E}, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2;	$\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL <sub>AE</sub> ;
		$\{R_7, R_7\}$ ;	2;	$-\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL <sub>AE</sub> ;
$\Lambda$ ; $\Gamma Z$ ;	$\bar{E}, \mathcal{T}\sigma_z$ ;	$R_2$ ;	1;	-1, 1;	
$V$ ; BD;	$\bar{E}, \mathcal{T}\sigma_z$ ;	$\{R_2, R_2\}$ ;	2;	$-\sigma_0, -i\sigma_2$ ;	WNL; $\pi$
$W$ ; YC;	$\bar{E}, \mathcal{T}\sigma_z$ ;	$R_2$ ;	1;	-1, 1;	
$U$ ; AE;	$\bar{E}, \mathcal{T}\sigma_z$ ;	$\{R_2, R_2\}$ ;	2;	$-\sigma_0, -i\sigma_2$ ;	WNL; $\pi$

## SG 8

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 $\Gamma_m^b; \{\sigma_z|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; (000);	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	P-WNL;
$A$ ; ( $\frac{1}{2}00$ );	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	P-WNL;
$Z$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	P-WNL;
$M$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	P-WNL;
$L$ ; ( $\frac{1}{2}0\frac{1}{2}$ );	$\bar{E}, \mathcal{T};$	$\{R_2, R_2\};$	2;	$-\sigma_0, -i\sigma_2;$	C-1 WP; 1
$V$ ; ( $00\frac{1}{2}$ );	$\bar{E}, \mathcal{T};$	$\{R_2, R_2\};$	2;	$-\sigma_0, -i\sigma_2;$	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ;	$\bar{E}, \mathcal{T}\sigma_z;$	$R_2;$	1;	$-1, 1;$	
$U$ ; AM;	$\bar{E}, \mathcal{T}\sigma_z;$	$R_2;$	1;	$-1, 1;$	

## SG 9

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 $\Gamma_m^b; \{\sigma_z|\frac{1}{2}00\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; (000);	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	P-WNL;
$A$ ; ( $\frac{1}{2}00$ );	$\sigma_z, \mathcal{T};$	$\{R_1, R_1\};$	2;	$\sigma_0, -i\sigma_2;$	P-WNL <sub>AM</sub> ;
		$\{R_3, R_3\};$	2;	$-\sigma_0, -i\sigma_2;$	P-WNL <sub>AM</sub> ;
$Z$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	P-WNL;
$M$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, \mathcal{T};$	$\{R_1, R_1\};$	2;	$\sigma_0, -i\sigma_2;$	P-WNL <sub>AM</sub> ;
		$\{R_3, R_3\};$	2;	$-\sigma_0, -i\sigma_2;$	P-WNL <sub>AM</sub> ;
$L$ ; ( $\frac{1}{2}0\frac{1}{2}$ );	$\bar{E}, \mathcal{T};$	$\{R_2, R_2\};$	2;	$-\sigma_0, -i\sigma_2;$	C-1 WP; 1
$V$ ; ( $00\frac{1}{2}$ );	$\bar{E}, \mathcal{T};$	$\{R_2, R_2\};$	2;	$-\sigma_0, -i\sigma_2;$	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ;	$\bar{E}, \mathcal{T}\sigma_z;$	$R_2;$	1;	$-1, 1;$	
$U$ ; AM;	$\bar{E}, \mathcal{T}\sigma_z;$	$\{R_2, R_2\};$	2;	$-\sigma_0, -i\sigma_2;$	WNL; $\pi$



SG 10

 $\Gamma_m; \{C_{2z}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

- $\Gamma; (000); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $B; (\frac{1}{2}00); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $Y; (0\frac{1}{2}0); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $Z; (00\frac{1}{2}); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $C; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $D; (\frac{1}{2}0\frac{1}{2}); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $A; (\frac{1}{2}\frac{1}{2}0); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $E; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $\Lambda; \Gamma Z; C_{2z}, I\mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$   
 $V; BD; C_{2z}, I\mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$   
 $W; YC; C_{2z}, I\mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$   
 $U; AE; C_{2z}, I\mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$

## SG 11

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 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$B; (\frac{1}{2}00);$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$Y; (0\frac{1}{2}0);$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$Z; (00\frac{1}{2});$	$C_{2z}, E, I, \mathcal{T};$	$\{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$ DP; 0
$C; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, E, I, \mathcal{T};$	$\{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$ DP; 0
$D; (\frac{1}{2}0\frac{1}{2});$	$C_{2z}, E, I, \mathcal{T};$	$\{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$ DP; 0
$A; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$E; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, E, I, \mathcal{T};$	$\{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$ DP; 0
$\Lambda; \Gamma Z;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$
$V; BD;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$
$W; YC;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$
$U; AE;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$

## SG 12

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 $\Gamma_m^b; \{C_{2z}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$A; (\frac{1}{2}00);$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$Z; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$M; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$L; (\frac{1}{2}0\frac{1}{2});$	$I, \bar{E}, \mathcal{T};$	$\{R_2, R_2\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$ $\{R_4, R_4\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$
$V; (00\frac{1}{2});$	$I, \bar{E}, \mathcal{T};$	$\{R_2, R_2\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$ $\{R_4, R_4\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$
$\Lambda; \Gamma Z;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$
$U; AM;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$

SG 13

 $\Gamma_m; \{C_{2z}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $B; (\bar{1}\frac{1}{2}00); \sigma_z, E, I, \mathcal{T}; \{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$  DP; 0  
 $Y; (0\frac{1}{2}0); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $Z; (00\frac{1}{2}); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $C; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$   
 $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$   
 $D; (\bar{1}\frac{1}{2}0\frac{1}{2}); \sigma_z, E, I, \mathcal{T}; \{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$  DP; 0  
 $A; (\frac{1}{2}\frac{1}{2}0); \sigma_z, E, I, \mathcal{T}; \{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$  DP; 0  
 $E; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); \sigma_z, E, I, \mathcal{T}; \{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$  DP; 0  
 $\Lambda; \Gamma_Z; C_{2z}, I\mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$   
 $V; \text{BD}; C_{2z}, I\mathcal{T}; \{R_2, R_2\}; 2; i\sigma_0, -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -i\sigma_0, -i\sigma_2;$   
 $W; \text{YC}; C_{2z}, I\mathcal{T}; \{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$   
 $U; \text{AE}; C_{2z}, I\mathcal{T}; \{R_2, R_2\}; 2; i\sigma_0, -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -i\sigma_0, -i\sigma_2;$

## SG 14

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 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \{I|\frac{1}{2}0\frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$\Gamma$ ; (000);	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$B$ ; ( $\frac{1}{2}00$ );	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0}; \text{DP}; 0$
$Y$ ; ( $0\frac{1}{2}0$ );	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$Z$ ; ( $00\frac{1}{2}$ );	$C_{2z}, E, I, \mathcal{T};$	$\{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0}; \text{DP}; 0$
$C$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, E, I, \mathcal{T};$	$\{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0}; \text{DP}; 0$
$D$ ; ( $\frac{1}{2}0\frac{1}{2}$ );	$C_{2z}, I, \mathcal{T};$	$\{R_1, R_1\}; 2; \sigma_0, \sigma_0, -i\sigma_2;$ $\{R_3, R_3\}; 2; -\sigma_0, \sigma_0, -i\sigma_2;$ $\{R_5, R_5\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$ $\{R_7, R_7\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$
$A$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0}; \text{DP}; 0$
$E$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, I, \mathcal{T};$	$\{R_1, R_1\}; 2; \sigma_0, \sigma_0, -i\sigma_2;$ $\{R_3, R_3\}; 2; -\sigma_0, \sigma_0, -i\sigma_2;$ $\{R_5, R_5\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$ $\{R_7, R_7\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$
$V$ ; $BD$ ;	$C_{2z}, I\mathcal{T};$	$\{R_2, R_2\}; 2; i\sigma_0, -i\sigma_2;$ $\{R_4, R_4\}; 2; -i\sigma_0, -i\sigma_2;$
$W$ ; $YC$ ;	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$
$U$ ; $AE$ ;	$C_{2z}, I\mathcal{T};$	$\{R_2, R_2\}; 2; i\sigma_0, -i\sigma_2;$ $\{R_4, R_4\}; 2; -i\sigma_0, -i\sigma_2;$

## SG 15

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 $\Gamma_m^b; \{C_{2z}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$\Gamma$ ; (000);	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$A$ ; ( $\frac{1}{2}00$ );	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0}; \text{DP}; 0$
$Z$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \sigma_0, -i\sigma_2;$ $\{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$M$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\}; 4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0}; \text{DP}; 0$
$L$ ; ( $\frac{1}{2}0\frac{1}{2}$ );	$I, \bar{E}, \mathcal{T};$	$\{R_2, R_2\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$ $\{R_4, R_4\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$
$V$ ; ( $00\frac{1}{2}$ );	$I, \bar{E}, \mathcal{T};$	$\{R_2, R_2\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$ $\{R_4, R_4\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$
$U$ ; $AM$ ;	$C_{2z}, I\mathcal{T};$	$\{R_2, R_2\}; 2; i\sigma_0, -i\sigma_2;$ $\{R_4, R_4\}; 2; -i\sigma_0, -i\sigma_2;$

SG 16

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$Y$ ; ( $\bar{1}\frac{1}{2}0$ );	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$X$ ; ( $0\frac{1}{2}0$ );	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$Z$ ; ( $00\frac{1}{2}$ );	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$U$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$T$ ; ( $\bar{1}\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$S$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$R$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$\Delta$ ; $\Gamma Y$ ;	$C_{2y}, \mathcal{T}C_{2x}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;
$D$ ; XS;	$C_{2y}, \mathcal{T}C_{2x}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;
$P$ ; UR;	$C_{2y}, \mathcal{T}C_{2x}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;
$B$ ; ZT;	$C_{2y}, \mathcal{T}C_{2x}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;
$\Sigma$ ; $\Gamma X$ ;	$C_{2x}, \mathcal{T}C_{2z}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;
$C$ ; YS;	$C_{2x}, \mathcal{T}C_{2z}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;
$E$ ; TR;	$C_{2x}, \mathcal{T}C_{2z}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;
$A$ ; ZU;	$C_{2x}, \mathcal{T}C_{2z}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}, \mathcal{T}C_{2x}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;
$H$ ; YT;	$C_{2z}, \mathcal{T}C_{2x}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;
$Q$ ; SR;	$C_{2z}, \mathcal{T}C_{2x}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;
$G$ ; XU;	$C_{2z}, \mathcal{T}C_{2x}$ ; $R_2$ ; 1; $i, 1$ ;
	$R_4$ ; 1; $-i, 1$ ;

SG 17

 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; $(000)$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
$Y$ ; $(\frac{1}{2}00)$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
$X$ ; $(0\frac{1}{2}0)$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
$Z$ ; $(00\frac{1}{2})$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZUTR</sub> ;	
	$\{R_7, R_8\}$ ;	2; $\sigma_0, -i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZUTR</sub> ;	
$U$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZUTR</sub> ;	
	$\{R_7, R_8\}$ ;	2; $\sigma_0, -i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZUTR</sub> ;	
$T$ ; $(\frac{1}{2}0\frac{1}{2})$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZUTR</sub> ;	
	$\{R_7, R_8\}$ ;	2; $\sigma_0, -i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZUTR</sub> ;	
$S$ ; $(\frac{1}{2}\frac{1}{2}0)$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
$R$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZUTR</sub> ;	
	$\{R_7, R_8\}$ ;	2; $\sigma_0, -i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZUTR</sub> ;	
$\Delta$ ; $\Gamma Y$ ;	$C_{2y}, \mathcal{T}C_{2x}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$D$ ; $XS$ ;	$C_{2y}, \mathcal{T}C_{2x}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$P$ ; $UR$ ;	$C_{2y}, \mathcal{T}C_{2x}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;
$B$ ; $ZT$ ;	$C_{2y}, \mathcal{T}C_{2x}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	L-NS <sub>ZUTR</sub> ;
$\Sigma$ ; $\Gamma X$ ;	$C_{2x}, \mathcal{T}C_{2z}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$C$ ; $YS$ ;	$C_{2x}, \mathcal{T}C_{2z}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$E$ ; $TR$ ;	$C_{2x}, \bar{E}, \mathcal{T}C_{2z}$ ;	$\{R_5, R_7\}$ ;	2; $-i\sigma_3, -\sigma_0, -i\sigma_2$ ;	L-NS <sub>ZUTR</sub> ;
$A$ ; $ZU$ ;	$C_{2x}, \bar{E}, \mathcal{T}C_{2z}$ ;	$\{R_5, R_7\}$ ;	2; $-i\sigma_3, -\sigma_0, -i\sigma_2$ ;	L-NS <sub>ZUTR</sub> ;
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}, \mathcal{T}C_{2x}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$H$ ; $YT$ ;	$C_{2z}, \mathcal{T}C_{2x}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$Q$ ; $SR$ ;	$C_{2z}, \mathcal{T}C_{2x}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$G$ ; $XU$ ;	$C_{2z}, \mathcal{T}C_{2x}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP;	1
$Y; (\bar{1}00);$	$C_{2y}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>YTSR</sub> ;	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>YTSR</sub> ;	
$X; (0\frac{1}{2}0);$	$C_{2x}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>XUSR</sub> ;	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>XUSR</sub> ;	
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP;	1
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2x}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>XUSR</sub> ;	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>XUSR</sub> ;	
$T; (\bar{1}0\frac{1}{2});$	$C_{2y}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>YTSR</sub> ;	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>YTSR</sub> ;	
$S; (\bar{1}\frac{1}{2}0);$	$C_{2z}, C_{2x}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	C-2 DP;	2
$R; (\bar{1}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2x}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	C-2 DP;	2
$\Delta; \Gamma Y;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D; \text{XS};$	$C_{2y}, \bar{E}, \mathcal{T}C_{2x};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_0, -i\sigma_2;$	L-NS <sub>XUSR</sub> ;	
$P; \text{UR};$	$C_{2y}, \bar{E}, \mathcal{T}C_{2x};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_0, -i\sigma_2;$	L-NS <sub>XUSR</sub> ;	
$B; \text{ZT};$	$C_{2y}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Sigma; \Gamma X;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; \text{YS};$	$C_{2x}, \bar{E}, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	$2; i\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>YTSR</sub> ;	
$E; \text{TR};$	$C_{2x}, \bar{E}, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	$2; i\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>YTSR</sub> ;	
$A; \text{ZU};$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Lambda; \Gamma Z;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$H; \text{YT};$	$C_{2z}, \mathcal{T}C_{2x};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	L-NS <sub>YTSR</sub> ;	
$Q; \text{SR};$	$C_{2z}, \mathcal{T}C_{2x};$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$	L-NSs;	
		$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$	L-NSs;	
$G; \text{XU};$	$C_{2z}, \mathcal{T}C_{2x};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	L-NS <sub>XUSR</sub> ;	

$\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP;	1
$Y; (\bar{1}00);$	$C_{2y}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>YSTR</sub> ;	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>YSTR</sub> ;	
$X; (0\frac{1}{2}0);$	$C_{2x}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>XUSR</sub> ;	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>XUSR</sub> ;	
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ZUTR</sub> ;	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>ZUTR</sub> ;	
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2y}, C_{2z}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	C-2 DP;	2
$T; (\bar{1}0\frac{1}{2});$	$C_{2x}, C_{2y}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	C-2 DP;	2
$S; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2x}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	C-2 DP;	2
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2x}, C_{2y}, \bar{E}, \mathcal{T};$	$\{R_6, R_6\};$	$2; \sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$	P-NSs;	
		$\{R_7, R_7\};$	$2; \sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$	P-NSs;	
		$\{R_8, R_8\};$	$2; -\sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$	P-NSs;	
		$\{R_9, R_9\};$	$2; -\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$	P-NSs;	
$\Delta; \Gamma Y;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D; X S;$	$C_{2y}, \bar{E}, \mathcal{T}C_{2x};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_0, -i\sigma_2;$	L-NS <sub>XUSR</sub> ;	
$P; U R;$	$C_{2y}, \bar{E}, \mathcal{T}C_{2x};$	$\{R_5, R_5\};$	$2; -i\sigma_0, -\sigma_0, -i\sigma_2;$	L-NSs;	
		$\{R_7, R_7\};$	$2; i\sigma_0, -\sigma_0, -i\sigma_2;$	L-NSs;	
$B; Z T;$	$C_{2y}, \mathcal{T}C_{2x};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	P-NS <sub>ZUTR</sub> ;	
$\Sigma; \Gamma X;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; Y S;$	$C_{2x}, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	P-NS <sub>YSTR</sub> ;	
$E; T R;$	$C_{2x}, \bar{E}, \mathcal{T}C_{2z};$	$\{R_5, R_5\};$	$2; -i\sigma_0, -\sigma_0, -i\sigma_2;$	L-NSs;	
		$\{R_7, R_7\};$	$2; i\sigma_0, -\sigma_0, -i\sigma_2;$	L-NSs;	
$A; Z U;$	$C_{2x}, \bar{E}, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_0, -i\sigma_2;$	P-NS <sub>ZUTR</sub> ;	
$\Lambda; \Gamma Z;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$H; Y T;$	$C_{2z}, \bar{E}, \mathcal{T}C_{2x};$	$\{R_5, R_7\};$	$2; i\sigma_3, -\sigma_0, \sigma_1;$	P-NS <sub>YSTR</sub> ;	
$Q; S R;$	$C_{2z}, \bar{E}, \mathcal{T}C_{2x};$	$\{R_5, R_5\};$	$2; i\sigma_0, -\sigma_0, -i\sigma_2;$	L-NSs;	
		$\{R_7, R_7\};$	$2; -i\sigma_0, -\sigma_0, -i\sigma_2;$	L-NSs;	
$G; X U;$	$C_{2z}, \mathcal{T}C_{2x};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	L-NS <sub>XUSR</sub> ;	



SG 20

 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ZTR</sub> ;
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>ZTR</sub> ;
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ZTR</sub> ;
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>ZTR</sub> ;
$S; (0\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \bar{E}, \mathcal{T};$	$\{R_5, R_5\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$	P-NS <sub>ZTR</sub> ;
		$\{R_7, R_7\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$	P-NS <sub>ZTR</sub> ;
$\Lambda; \Gamma Z;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$H; Y\bar{T};$	$C_{2z}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$D; S\bar{R};$	$C_{2z};$	$R_2;$	$1; i;$	
		$R_4;$	$1; -i;$	
$A; Z\bar{T};$	$C_{2x}, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	L-NS <sub>ZTR</sub> ;
$\Sigma; \Gamma Y;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$\Delta; \Gamma\Delta;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$B; Z\bar{B};$	$C_{2y}, \bar{E}, \mathcal{T}C_{2x};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>ZTR</sub> ;
$G; T\bar{G};$	$C_{2y}, \bar{E}, \mathcal{T}C_{2x};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>ZTR</sub> ;
$F; Y\bar{F};$	$C_{2y}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$E; T\bar{E};$	$C_{2x}, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	L-NS <sub>ZTR</sub> ;
$C; Y\bar{C};$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	

## 4. SG 21-30

SG 21

 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	2; $i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$Y$ ; $(\frac{1}{2}\frac{1}{2}0)$ ;	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	2; $i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$Z$ ; $(00\frac{1}{2})$ ;	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	2; $i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$T$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	2; $i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$S$ ; $(0\frac{1}{2}0)$ ;	$C_{2z}, \mathcal{T}; \{R_2, R_4\};$	2; $i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$R$ ; $(0\frac{1}{2}\frac{1}{2})$ ;	$C_{2z}, \mathcal{T}; \{R_2, R_4\};$	2; $i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}, \mathcal{T}C_{2x}; R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	
$H$ ; YT;	$C_{2z}, \mathcal{T}C_{2x}; R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	
$D$ ; SR;	$C_{2z}; R_2;$	1; $i;$	
	$R_4;$	1; $-i;$	
$A$ ; ZT;	$C_{2x}, \mathcal{T}C_{2z}; R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	
$\Sigma$ ; $\Gamma Y$ ;	$C_{2x}, \mathcal{T}C_{2z}; R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	
$\Delta$ ; $\Gamma \Delta$ ;	$C_{2y}, \mathcal{T}C_{2x}; R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	
$B$ ; ZB;	$C_{2y}, \mathcal{T}C_{2x}; R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	
$G$ ; TG;	$C_{2y}, \mathcal{T}C_{2x}; R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	
$F$ ; YF;	$C_{2y}, \mathcal{T}C_{2x}; R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	
$E$ ; TE;	$C_{2x}, \mathcal{T}C_{2z}; R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	
$C$ ; YC;	$C_{2x}, \mathcal{T}C_{2z}; R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	

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 $\Gamma_o^f; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$Y; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$X; (\frac{1}{2}0\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$Z; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$L; (\frac{1}{2}00);$	$\bar{E}, \mathcal{T};$	$\{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$	C-1 WP; 1
$\Lambda; \Gamma Z/\Gamma \Lambda;$	$C_{2z}, \mathcal{T}C_{2x}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$G; XG/XY;$	$C_{2z}, \mathcal{T}C_{2x}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$H; YH/YX;$	$C_{2z}, \mathcal{T}C_{2x}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$Q; ZQ;$	$C_{2z}, \mathcal{T}C_{2x}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$\Sigma; \Gamma X/\Gamma \Sigma;$	$C_{2x}, \mathcal{T}C_{2z}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$C; YC/YZ;$	$C_{2x}, \mathcal{T}C_{2z}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$A; ZA/ZY;$	$C_{2x}, \mathcal{T}C_{2z}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$U; XU;$	$C_{2x}, \mathcal{T}C_{2z}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$\Delta; \Gamma Y/\Gamma \Delta;$	$C_{2y}, \mathcal{T}C_{2x}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$D; XD/XZ;$	$C_{2y}, \mathcal{T}C_{2x}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$B; ZB/ZX;$	$C_{2y}, \mathcal{T}C_{2x}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$R; YR;$	$C_{2y}, \mathcal{T}C_{2x}; R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	

SG 23

 $\Gamma_o^v; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$X$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$R$ ; $(\frac{1}{2}00)$ ;	$C_{2y}, \mathcal{T}$ ; $\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ; C-1 WP; 1
$S$ ; $(\frac{1}{2}0\frac{1}{2})$ ;	$C_{2x}, \mathcal{T}$ ; $\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ; C-1 WP; 1
$T$ ; $(\frac{1}{2}\frac{1}{2}0)$ ;	$C_{2z}, \mathcal{T}$ ; $\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ; C-1 WP; 1
$W$ ; $(\frac{3}{4}\frac{1}{4}\frac{1}{4})$ ;	$C_{2z}, C_{2y}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma\Lambda/\Gamma X$ ;	$C_{2z}, \mathcal{T}C_{2x}$ ; $R_2$ ;	1; $i, 1$ ;
	$R_4$ ;	1; $-i, 1$ ;
$G$ ; $XG$ ;	$C_{2z}, \mathcal{T}C_{2x}$ ; $R_2$ ;	1; $i, 1$ ;
	$R_4$ ;	1; $-i, 1$ ;
$P$ ; $TW$ ;	$C_{2z}$ ; $R_2$ ;	1; $i$ ;
	$R_4$ ;	1; $-i$ ;
$\Sigma$ ; $\Gamma\Sigma/\Gamma X$ ;	$C_{2x}, \mathcal{T}C_{2z}$ ; $R_2$ ;	1; $i, 1$ ;
	$R_4$ ;	1; $-i, 1$ ;
$F$ ; $XF$ ;	$C_{2x}, \mathcal{T}C_{2z}$ ; $R_2$ ;	1; $i, 1$ ;
	$R_4$ ;	1; $-i, 1$ ;
$D$ ; $SW$ ;	$C_{2x}$ ; $R_2$ ;	1; $i$ ;
	$R_4$ ;	1; $-i$ ;
$\Delta$ ; $\Gamma\Delta/\Gamma X$ ;	$C_{2y}, \mathcal{T}C_{2x}$ ; $R_2$ ;	1; $i, 1$ ;
	$R_4$ ;	1; $-i, 1$ ;
$U$ ; $XU$ ;	$C_{2y}, \mathcal{T}C_{2x}$ ; $R_2$ ;	1; $i, 1$ ;
	$R_4$ ;	1; $-i, 1$ ;
$Q$ ; $RW$ ;	$C_{2y}$ ; $R_2$ ;	1; $i$ ;
	$R_4$ ;	1; $-i$ ;

SG 24

 $\Gamma_o^v; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$X; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$R; (\frac{1}{2}00);$	$C_{2y}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$S; (\frac{1}{2}0\frac{1}{2});$	$C_{2x}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$T; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$W; (\frac{3}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, C_{2y};$	$R_1;$	$1; 1, 1;$	
		$R_2;$	$1; 1, -1;$	
		$R_3;$	$1; -1, 1;$	
		$R_4;$	$1; -1, -1;$	
$\Lambda; \Gamma\Lambda/\Gamma X;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$G; XG;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_2;$	$1; -i, 1;$	
		$R_4;$	$1; i, 1;$	
$P; TW;$	$C_{2z}, \bar{E};$	$R_5;$	$1; -i, -1;$	
		$R_7;$	$1; i, -1;$	
$\Sigma; \Gamma\Sigma/\Gamma X;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$F; XF;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	$1; -i, 1;$	
		$R_4;$	$1; i, 1;$	
$D; SW;$	$C_{2x}, \bar{E};$	$R_5;$	$1; i, -1;$	
		$R_7;$	$1; -i, -1;$	
$\Delta; \Gamma\Delta/\Gamma X;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$U; XU;$	$C_{2y}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$Q; RW;$	$C_{2y}, \bar{E};$	$R_5;$	$1; -i, -1;$	
		$R_7;$	$1; i, -1;$	

SG 25

 $\Gamma_o; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; (000);	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; P-WNL $_{\Gamma Z}$ ;		
$Y$ ; ( $\bar{1}00$ );	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; P-WNL $_{YT}$ ;		
$X$ ; ( $0\frac{1}{2}0$ );	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; P-WNL $_{XU}$ ;		
$Z$ ; ( $00\frac{1}{2}$ );	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; P-WNL $_{\Gamma Z}$ ;		
$U$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; P-WNL $_{XU}$ ;		
$T$ ; ( $\bar{1}0\frac{1}{2}$ );	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; P-WNL $_{YT}$ ;		
$S$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; P-WNL $_{SR}$ ;		
$R$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ; P-WNL $_{SR}$ ;		
$\Delta$ ; $\Gamma Y$ ;	$\sigma_x, \mathcal{T}C_{2z}$ ; $R_2$ ; 1; $i, 1$ ;		
	$R_4$ ; 1; $-i, 1$ ;		
$D$ ; XS;	$\sigma_x, \mathcal{T}C_{2z}$ ; $R_2$ ; 1; $i, 1$ ;		
	$R_4$ ; 1; $-i, 1$ ;		
$P$ ; UR;	$\sigma_x, \mathcal{T}C_{2z}$ ; $R_2$ ; 1; $i, 1$ ;		
	$R_4$ ; 1; $-i, 1$ ;		
$B$ ; ZT;	$\sigma_x, \mathcal{T}C_{2z}$ ; $R_2$ ; 1; $i, 1$ ;		
	$R_4$ ; 1; $-i, 1$ ;		
$\Sigma$ ; $\Gamma X$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ; $R_2$ ; 1; $i, 1$ ;		
	$R_4$ ; 1; $-i, 1$ ;		
$C$ ; YS;	$\sigma_y, \mathcal{T}\sigma_x$ ; $R_2$ ; 1; $i, 1$ ;		
	$R_4$ ; 1; $-i, 1$ ;		
$E$ ; TR;	$\sigma_y, \mathcal{T}\sigma_x$ ; $R_2$ ; 1; $i, 1$ ;		
	$R_4$ ; 1; $-i, 1$ ;		
$A$ ; ZU;	$\sigma_y, \mathcal{T}\sigma_x$ ; $R_2$ ; 1; $i, 1$ ;		
	$R_4$ ; 1; $-i, 1$ ;		
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}, \sigma_y$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1$ ;	WNL;	$\pi$
$H$ ; YT;	$C_{2z}, \sigma_y$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1$ ;	WNL;	$\pi$
$Q$ ; SR;	$C_{2z}, \sigma_y$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1$ ;	WNL;	$\pi$
$G$ ; XU;	$C_{2z}, \sigma_y$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1$ ;	WNL;	$\pi$

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 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; (000);	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
$Y$ ; ( $\bar{1}00$ );	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{YT}$ ;	
$X$ ; ( $0\frac{1}{2}0$ );	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{XU}$ ;	
$Z$ ; ( $00\frac{1}{2}$ );	$\sigma_x, \sigma_y, \mathcal{T}$ ; $\{R_9, R_9\}$ ;	4; $i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1}$ ;	DP;	0
$U$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$\sigma_x, \sigma_y, \mathcal{T}$ ; $\{R_9, R_9\}$ ;	4; $i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1}$ ;	DP;	0
$T$ ; ( $\bar{1}0\frac{1}{2}$ );	$\sigma_x, \sigma_y, \mathcal{T}$ ; $\{R_9, R_9\}$ ;	4; $i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1}$ ;	DP;	0
$S$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$C_{2z}, \sigma_y, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{SR}$ ;	
$R$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$\sigma_x, \sigma_y, \mathcal{T}$ ; $\{R_9, R_9\}$ ;	4; $i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1}$ ;	DP;	0
$\Delta$ ; $\Gamma Y$ ;	$\sigma_x, \mathcal{T}C_{2z}$ ; $R_2$ ;	1; $i, 1$ ;		
	$R_4$ ;	1; $-i, 1$ ;		
$D$ ; XS;	$\sigma_x, \mathcal{T}C_{2z}$ ; $R_2$ ;	1; $i, 1$ ;		
	$R_4$ ;	1; $-i, 1$ ;		
$P$ ; UR;	$\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2, R_2\}$ ;	2; $i\sigma_0, -i\sigma_2$ ;	L-NS $_{ZUTR}$ ;	
	$\{R_4, R_4\}$ ;	2; $-i\sigma_0, -i\sigma_2$ ;	L-NS $_{ZUTR}$ ;	
$B$ ; ZT;	$\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2, R_2\}$ ;	2; $i\sigma_0, -i\sigma_2$ ;	L-NS $_{ZUTR}$ ;	
	$\{R_4, R_4\}$ ;	2; $-i\sigma_0, -i\sigma_2$ ;	L-NS $_{ZUTR}$ ;	
$\Sigma$ ; $\Gamma X$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ; $R_2$ ;	1; $i, 1$ ;		
	$R_4$ ;	1; $-i, 1$ ;		
$C$ ; YS;	$\sigma_y, \mathcal{T}\sigma_x$ ; $R_2$ ;	1; $i, 1$ ;		
	$R_4$ ;	1; $-i, 1$ ;		
$E$ ; TR;	$\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2, R_4\}$ ;	2; $\sigma_3, \sigma_1$ ;	L-NS $_{ZUTR}$ ;	
$A$ ; ZU;	$\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2, R_4\}$ ;	2; $\sigma_3, \sigma_1$ ;	L-NS $_{ZUTR}$ ;	
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}, \sigma_y$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1$ ;	WNL;	$\pi$
$H$ ; YT;	$C_{2z}, \sigma_y$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1$ ;	WNL;	$\pi$
$Q$ ; SR;	$C_{2z}, \sigma_y$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1$ ;	WNL;	$\pi$
$G$ ; XU;	$C_{2z}, \sigma_y$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1$ ;	WNL;	$\pi$

SG 27

 $\Gamma_o; \{C_{2z}|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{\Gamma Z};$	
$Y; (\bar{1}\frac{1}{2}00);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{YT};$	
$X; (0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{XU};$	
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	$\text{DP};$	0
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	$\text{DP};$	0
$T; (\bar{1}\frac{1}{2}0\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	$\text{DP};$	0
$S; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{SR};$	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	$\text{DP};$	0
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D; \text{XS};$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$P; \text{UR};$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	$\text{WNL};$	$\pi$
$B; \text{ZT};$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	$\text{WNL};$	$\pi$
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; \text{YS};$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$E; \text{TR};$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	$\text{WNL};$	$\pi$
$A; \text{ZU};$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	$\text{WNL};$	$\pi$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$
$H; \text{YT};$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$
$Q; \text{SR};$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$
$G; \text{XU};$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$



$\Gamma_o; \{C_{2z}|\frac{1}{2}00\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$Y; (\bar{1}00);$	$\sigma_x, \sigma_y, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
$X; (0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XU};$	
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XU};$	
$T; (\bar{1}0\frac{1}{2});$	$\sigma_x, \sigma_y, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{TR};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{TR};$	
$S; (\bar{1}\frac{1}{2}0);$	$\sigma_x, \sigma_y, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
$R; (\bar{1}\frac{1}{2}\frac{1}{2});$	$\sigma_x, \sigma_y, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{TR};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{TR};$	
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D; XS;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$P; UR;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$B; ZT;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; YS;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; TR;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$A; ZU;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$H; YT;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$Q; SR;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$G; XU;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$

$\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$Y; (\bar{1}00);$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
$X; (0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XU};$	
$Z; (00\frac{1}{2});$	$\sigma_x, \sigma_y, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_x, \sigma_y, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$T; (\bar{1}0\frac{1}{2});$	$\sigma_x, \sigma_y, \bar{E}, \mathcal{T};$	$\{R_6, R_6\};$	$2; \sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
		$\{R_7, R_7\};$	$2; \sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
		$\{R_8, R_8\};$	$2; -\sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
		$\{R_9, R_9\};$	$2; -\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
$S; (\bar{1}\frac{1}{2}0);$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
$R; (\bar{1}\frac{1}{2}\frac{1}{2});$	$\sigma_x, \sigma_y, \bar{E}, \mathcal{T};$	$\{R_6, R_6\};$	$2; \sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
		$\{R_7, R_7\};$	$2; \sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
		$\{R_8, R_8\};$	$2; -\sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
		$\{R_9, R_9\};$	$2; -\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D; X S;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$P; U R;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
		$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
$B; Z T;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
		$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; Y S;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; T R;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_2\};$	$2; \sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
		$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
$A; Z U;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	L-NS $_{ZUTR};$	
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$H; Y T;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$Q; S R;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$G; X U;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$

$\Gamma_o; \{C_{2z}|\frac{1}{2}00\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$Y; (\bar{1}\frac{1}{2}00);$	$\sigma_x, \sigma_y, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
$X; (0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XU};$	
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$T; (\bar{1}\frac{1}{2}0\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
$S; (\bar{1}\frac{1}{2}\frac{1}{2}0);$	$\sigma_x, \sigma_y, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
$R; (\bar{1}\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{UR};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{UR};$	
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D; X S;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$P; U R;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$B; Z T;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; Y S;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; T R;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; 1, 1;$		
		$R_4;$	$1; -1, 1;$		
$A; Z U;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$H; Y T;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$Q; S R;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$G; X U;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$

## 5. SG 31-40

SG 31

 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$Y; (\bar{1}\frac{1}{2}00);$	$\sigma_x, \sigma_y, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
$X; (0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XU};$	
$Z; (00\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$T; (\bar{1}\frac{1}{2}0\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS $_{ZUTR};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS $_{ZUTR};$	
$S; (\bar{1}\frac{1}{2}\frac{1}{2}0);$	$\sigma_x, \sigma_y, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
$R; (\bar{1}\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS $_{ZUTR};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS $_{ZUTR};$	
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D; XS;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$P; UR;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	L-NS $_{ZUTR};$	
$B; ZT;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	L-NS $_{ZUTR};$	
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; YS;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; TR;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	L-NS $_{ZUTR};$	
$A; ZU;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
		$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$H; YT;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$Q; SR;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$G; XU;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$

$\Gamma_o; \{C_{2z}|\frac{1}{2}\frac{1}{2}0\}, \{\sigma_y|0\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$Y; (\bar{1}\frac{1}{2}00);$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
$X; (0\frac{1}{2}0);$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XS};$	
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{UR};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{UR};$	
$T; (\bar{1}\frac{1}{2}0\frac{1}{2});$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{TR};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{TR};$	
$S; (\bar{1}\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$R; (\bar{1}\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D; XS;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	WNL;	$\pi$
$P; UR;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	WNL;	$\pi$
$B; ZT;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; YS;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; TR;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$A; ZU;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$H; YT;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$Q; SR;$	$\sigma_x, \sigma_y, E;$	$R_{10};$	$2; -\sigma_2, \sigma_1, \sigma_0;$	WNL;	$\pi$
$G; XU;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; i, 1;$		
		$R_6;$	$1; i, -1;$		
		$R_7;$	$1; -i, -1;$		
		$R_8;$	$1; -i, 1;$		

$\Gamma_o; \{C_{2z}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_y|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000); C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$Y; (\bar{1}00); \sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
	$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
$X; (0\frac{1}{2}0); \sigma_y, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XS};$	
	$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XS};$	
$Z; (00\frac{1}{2}); \sigma_x, \sigma_y, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$U; (0\frac{1}{2}\frac{1}{2}); C_{2z}, \sigma_y, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS $_{ZUTR};$	
	$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS $_{ZUTR};$	
$T; (\bar{1}0\frac{1}{2}); \sigma_x, \sigma_y, \bar{E}, \mathcal{T};$	$\{R_6, R_6\};$	$2; \sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
	$\{R_7, R_7\};$	$2; \sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
	$\{R_8, R_8\};$	$2; -\sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
	$\{R_9, R_9\};$	$2; -\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZUTR};$	
$S; (\bar{1}\frac{1}{2}0); C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$R; (\bar{1}\frac{1}{2}\frac{1}{2}); \sigma_y, C_{2z}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$\Delta; \Gamma Y; \sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$D; XS; \sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	WNL;	$\pi$
$P; UR; \sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	L-NS $_{ZUTR};$	
$B; ZT; \sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
	$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
$\Sigma; \Gamma X; \sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$C; YS; \sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; TR; \sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_2\};$	$2; \sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
	$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$	L-NS $_{ZUTR};$	
$A; ZU; \sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	L-NS $_{ZUTR};$	
$\Lambda; \Gamma Z; C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$H; YT; C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
	$R_6;$	$1; -i, -i;$		
	$R_7;$	$1; i, -i;$		
	$R_8;$	$1; i, i;$		
$Q; SR; \sigma_x, \sigma_y, E;$	$R_{10};$	$2; -\sigma_2, \sigma_1, \sigma_0;$	WNL;	$\pi$
$G; XU; C_{2z}, \sigma_y;$	$R_5;$	$1; i, 1;$		
	$R_6;$	$1; i, -1;$		
	$R_7;$	$1; -i, -1;$		
	$R_8;$	$1; -i, 1;$		

$\Gamma_o; \{C_{2z}|\frac{1}{2}\frac{1}{2}0\}, \{\sigma_y|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$Y; (\bar{1}\frac{1}{2}00);$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YS};$	
$X; (0\frac{1}{2}0);$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XS};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XS};$	
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{ZU};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{ZU};$	
$T; (\bar{1}\frac{1}{2}0\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
$S; (\bar{1}\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$R; (\bar{1}\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{SR};$	
$\Delta; \Gamma Y;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D; XS;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	WNL;	$\pi$
$P; UR;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; 1, 1;$		
		$R_4;$	$1; -1, 1;$		
$B; ZT;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; YS;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$E; TR;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; 1, 1;$		
		$R_4;$	$1; -1, 1;$		
$A; ZU;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$H; YT;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$Q; SR;$	$\sigma_x, \sigma_y, E;$	$R_{10};$	$2; -\sigma_2, \sigma_1, \sigma_0;$	WNL;	$\pi$
$G; XU;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; i, 1;$		
		$R_6;$	$1; i, -1;$		
		$R_7;$	$1; -i, -1;$		
		$R_8;$	$1; -i, 1;$		

SG 35

 $\Gamma_o^b; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{YT};$	
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{YT};$	
$S; (0\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP;	1
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP;	1
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$H; YT;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$D; SR;$	$C_{2z};$	$R_2;$	$1; i;$		
		$R_4;$	$1; -i;$		
$A; ZT;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Sigma; \Gamma Y;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Delta; \Gamma\Delta;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$B; ZB;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$G; TG;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$F; YF;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$E; TE;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; YC;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		



SG 36

 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{YT};$	
$Z; (00\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$S; (0\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP;	1
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \bar{E}, \mathcal{T};$	$\{R_5, R_5\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZTR};$	
		$\{R_7, R_7\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$	P-NS $_{ZTR};$	
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$H; YT;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$D; SR;$	$C_{2z};$	$R_2;$	$1; i;$		
		$R_4;$	$1; -i;$		
$A; ZT;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$	L-NS $_{ZTR};$	
		$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$	L-NS $_{ZTR};$	
$\Sigma; \Gamma Y;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Delta; \Gamma \Delta;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$B; ZB;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	L-NS $_{ZTR};$	
$G; TG;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	L-NS $_{ZTR};$	
$F; YF;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$E; TE;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$	L-NS $_{ZTR};$	
		$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$	L-NS $_{ZTR};$	
$C; YC;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		

SG 37

 $\Gamma_o^b; \{C_{2z}|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{YT};$	
$Z; (00\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$S; (0\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP;	1
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP;	1
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$H; YT;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$D; SR;$	$C_{2z};$	$R_2;$	$1; i;$		
		$R_4;$	$1; -i;$		
$A; ZT;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Sigma; \Gamma Y;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Delta; \Gamma\Delta;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$B; ZB;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$G; TG;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$F; YF;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$E; TE;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$C; YC;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		

SG 38

 $\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{2y}, \sigma_x, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma\Delta};$	
$Y$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$C_{2y}, \sigma_x, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{YF};$	
$Z$ ; ( $00\frac{1}{2}$ );	$C_{2y}, \sigma_x, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{ZB};$	
$T$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{2y}, \sigma_x, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{TG};$	
$S$ ; ( $0\frac{1}{2}0$ );	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	P-WNL;	
$R$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	P-WNL;	
$\Lambda$ ; $\Gamma Z$ ;	$\sigma_x, \mathcal{T}\sigma_z;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$H$ ; YT;	$\sigma_x, \mathcal{T}\sigma_z;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D$ ; SR;	$\bar{E}, \mathcal{T}\sigma_z;$	$R_2;$	$1; -1, 1;$		
$A$ ; ZT;	$\sigma_z, \mathcal{T}C_{2y};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Sigma$ ; $\Gamma Y$ ;	$\sigma_z, \mathcal{T}C_{2y};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Delta$ ; $\Gamma\Delta$ ;	$C_{2y}, \sigma_x;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$B$ ; ZB;	$C_{2y}, \sigma_x;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$G$ ; TG;	$C_{2y}, \sigma_x;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$F$ ; YF;	$C_{2y}, \sigma_x;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$E$ ; TE;	$\sigma_z, \mathcal{T}C_{2y};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C$ ; YC;	$\sigma_z, \mathcal{T}C_{2y};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		

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 $\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; (000);	$C_{2y}, \sigma_x, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{\Gamma\Delta}$ ;	
$Y$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$C_{2y}, \sigma_x, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{YF}$ ;	
$Z$ ; ( $00\frac{1}{2}$ );	$C_{2y}, \sigma_x, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{ZB}$ ;	
$T$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{2y}, \sigma_x, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{TG}$ ;	
$S$ ; ( $0\frac{1}{2}0$ );	$\sigma_z, \bar{E}, \mathcal{T}$ ;	$\{R_5, R_5\}$ ; 2; $\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL $_{SR}$ ;	
		$\{R_7, R_7\}$ ; 2; $-\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL $_{SR}$ ;	
$R$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, \bar{E}, \mathcal{T}$ ;	$\{R_5, R_5\}$ ; 2; $\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL $_{SR}$ ;	
		$\{R_7, R_7\}$ ; 2; $-\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL $_{SR}$ ;	
$\Lambda$ ; $\Gamma Z$ ;	$\sigma_x, \mathcal{T}\sigma_z$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$H$ ; $YT$ ;	$\sigma_x, \mathcal{T}\sigma_z$ ;	$R_2$ ;	1; $-i, 1$ ;	
		$R_4$ ;	1; $i, 1$ ;	
$D$ ; $SR$ ;	$\bar{E}, \mathcal{T}\sigma_z$ ;	$\{R_2, R_2\}$ ; 2; $-\sigma_0, -i\sigma_2$ ;	WNL;	$\pi$
$A$ ; $ZT$ ;	$\sigma_z, \mathcal{T}C_{2y}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$\Sigma$ ; $\Gamma Y$ ;	$\sigma_z, \mathcal{T}C_{2y}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$\Delta$ ; $\Gamma\Delta$ ;	$C_{2y}, \sigma_x$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1$ ;	WNL; $\pi$
$B$ ; $ZB$ ;	$C_{2y}, \sigma_x$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1$ ;	WNL; $\pi$
$G$ ; $TG$ ;	$C_{2y}, \sigma_x$ ;	$R_5$ ;	2; $i\sigma_2, -i\sigma_1$ ;	WNL; $\pi$
$F$ ; $YF$ ;	$C_{2y}, \sigma_x$ ;	$R_5$ ;	2; $i\sigma_2, -i\sigma_1$ ;	WNL; $\pi$
$E$ ; $TE$ ;	$\sigma_z, \mathcal{T}C_{2y}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$C$ ; $YC$ ;	$\sigma_z, \mathcal{T}C_{2y}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	

SG 40

 $\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$ (000);	$C_{2y}, \sigma_x, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma\Delta};$	
$Y;$ ( $\frac{1}{2}\frac{1}{2}0$ );	$C_{2y}, \sigma_x, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{YF};$	
$Z;$ ( $00\frac{1}{2}$ );	$\sigma_x, C_{2y}, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
		$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
$T;$ ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$\sigma_x, C_{2y}, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
		$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
$S;$ ( $0\frac{1}{2}0$ );	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	P-WNL;	
$R;$ ( $0\frac{1}{2}\frac{1}{2}$ );	$\sigma_z, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	P-WNL;	
$\Lambda;$ $\Gamma Z;$	$\sigma_x, \mathcal{T}\sigma_z;$	$R_2;$	1;	$i, 1;$		
		$R_4;$	1;	$-i, 1;$		
$H;$ YT;	$\sigma_x, \mathcal{T}\sigma_z;$	$R_2;$	1;	$i, 1;$		
		$R_4;$	1;	$-i, 1;$		
$D;$ SR;	$\bar{E}, \mathcal{T}\sigma_z;$	$R_2;$	1;	$-1, 1;$		
$A;$ ZT;	$\sigma_z, \bar{E}, \mathcal{T}C_{2y};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, -\sigma_0, \sigma_1;$	WNL;	$\pi$
$\Sigma;$ $\Gamma Y;$	$\sigma_z, \mathcal{T}C_{2y};$	$R_2;$	1;	$i, 1;$		
		$R_4;$	1;	$-i, 1;$		
$\Delta;$ $\Gamma\Delta;$	$C_{2y}, \sigma_x;$	$R_5;$	2;	$i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$B;$ ZB;	$\sigma_z, C_{2y};$	$R_5;$	1;	$i, i;$		
		$R_6;$	1;	$i, -i;$		
		$R_7;$	1;	$-i, -i;$		
		$R_8;$	1;	$-i, i;$		
$G;$ TG;	$\sigma_z, C_{2y};$	$R_5;$	1;	$i, i;$		
		$R_6;$	1;	$i, -i;$		
		$R_7;$	1;	$-i, -i;$		
		$R_8;$	1;	$-i, i;$		
$F;$ YF;	$C_{2y}, \sigma_x;$	$R_5;$	2;	$i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$E;$ TE;	$\sigma_z, \bar{E}, \mathcal{T}C_{2y};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, -\sigma_0, \sigma_1;$	WNL;	$\pi$
$C;$ YC;	$\sigma_z, \mathcal{T}C_{2y};$	$R_2;$	1;	$i, 1;$		
		$R_4;$	1;	$-i, 1;$		

SG 41

 $\Gamma_{o;}^b; \{C_{2y}|000\}, \{\sigma_x|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2y}, \sigma_x, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma\Delta};$	
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2y}, \sigma_x, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{YF};$	
$Z; (00\frac{1}{2});$	$\sigma_x, C_{2y}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_x, C_{2y}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{ZT};$	
$S; (0\frac{1}{2}0);$	$\sigma_z, \bar{E}, \mathcal{T};$	$\{R_5, R_5\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{SR};$	
		$\{R_7, R_7\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{SR};$	
$R; (0\frac{1}{2}\frac{1}{2});$	$\sigma_z, \bar{E}, \mathcal{T};$	$\{R_5, R_5\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{SR};$	
		$\{R_7, R_7\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{SR};$	
$\Lambda; \Gamma Z;$	$\sigma_x, \mathcal{T}\sigma_z;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$H; YT;$	$\sigma_x, \mathcal{T}\sigma_z;$	$R_2;$	$1; -i, 1;$		
		$R_4;$	$1; i, 1;$		
$D; SR;$	$\bar{E}, \mathcal{T}\sigma_z;$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$A; ZT;$	$\sigma_z, \bar{E}, \mathcal{T}C_{2y};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_0, \sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma Y;$	$\sigma_z, \mathcal{T}C_{2y};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Delta; \Gamma\Delta;$	$C_{2y}, \sigma_x;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$B; ZB;$	$\sigma_z, C_{2y};$	$R_5;$	$1; i, i;$		
		$R_6;$	$1; i, -i;$		
		$R_7;$	$1; -i, -i;$		
		$R_8;$	$1; -i, i;$		
$G; TG;$	$\sigma_z, C_{2y};$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$F; YF;$	$C_{2y}, \sigma_x;$	$R_5;$	$2; i\sigma_2, -i\sigma_1;$	WNL;	$\pi$
$E; TE;$	$\sigma_z, \bar{E}, \mathcal{T}C_{2y};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_0, \sigma_1;$	WNL;	$\pi$
$C; YC;$	$\sigma_z, \mathcal{T}C_{2y};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		

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 $\Gamma_o^f; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{\Gamma Z/\Gamma \Lambda};$	
$Y; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{YH/YX};$	
$X; (\frac{1}{2}0\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{XG/XY};$	
$Z; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{ZQ};$	
$L; (\frac{1}{2}00);$	$\bar{E}, \mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	$\text{C-1 WP};$	1
$\Lambda; \Gamma Z/\Gamma \Lambda;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$
$G; XG/XY;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$
$H; YH/YX;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$
$Q; ZQ;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$
$\Sigma; \Gamma X/\Gamma \Sigma;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; YC/YZ;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$A; ZA/ZY;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$U; XU;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Delta; \Gamma Y/\Gamma \Delta;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D; XD/XZ;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$B; ZB/ZX;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$R; YR;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		

SG 43

 $\Gamma_o^f; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|\frac{1}{2}00\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z/\Gamma \Lambda};$	
$Y; (0\frac{1}{2}\frac{1}{2});$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{YC/YZ};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{YC/YZ};$	
$X; (\frac{1}{2}0\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XD/XZ};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XD/XZ};$	
$Z; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$L; (\frac{1}{2}00);$	$\bar{E}, \mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	C-1 WP;	1
$\Lambda; \Gamma Z/\Gamma \Lambda;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$G; XG/XY;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; i, 1;$		
		$R_6;$	$1; i, -1;$		
		$R_7;$	$1; -i, -1;$		
		$R_8;$	$1; -i, 1;$		
$H; YH/YX;$	$C_{2z}, \sigma_y;$	$R_5;$	$1; -i, i;$		
		$R_6;$	$1; -i, -i;$		
		$R_7;$	$1; i, -i;$		
		$R_8;$	$1; i, i;$		
$Q; ZQ;$	$C_{2z}, \sigma_y, \bar{E};$	$R_5;$	$2; i\sigma_2, \sigma_1, -\sigma_0;$	WNL;	$\pi$
$\Sigma; \Gamma X/\Gamma \Sigma;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$C; YC/YZ;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$A; ZA/ZY;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$U; XU;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; 1, 1;$		
		$R_4;$	$1; -1, 1;$		
$\Delta; \Gamma Y/\Gamma \Delta;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$D; XD/XZ;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	WNL;	$\pi$
$B; ZB/ZX;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$R; YR;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; 1, 1;$		
		$R_4;$	$1; -1, 1;$		



SG 44

 $\Gamma_o^v; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{\Gamma\Lambda/\Gamma X};$	
$X;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{XG};$	
$R;$	$(\frac{1}{2}00);$	$\sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	$\text{P-WNL};$	
$S;$	$(\frac{1}{2}0\frac{1}{2});$	$\sigma_x, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	$\text{P-WNL};$	
$T;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	$\text{C-1 WP};$	1
$W;$	$(\frac{3}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
			$R_4;$	$1; -i, 1;$		
$\Lambda;$	$\Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$
$G;$	$XG;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$
$P;$	$\text{TW};$	$C_{2z};$	$R_2;$	$1; i;$		
			$R_4;$	$1; -i;$		
$\Sigma;$	$\Gamma\Sigma/\Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
			$R_4;$	$1; -i, 1;$		
$F;$	$\text{XF};$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
			$R_4;$	$1; -i, 1;$		
$D;$	$\text{SW};$	$\bar{E}, \mathcal{T}\sigma_x;$	$R_2;$	$1; -1, 1;$		
$\Delta;$	$\Gamma\Delta/\Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
			$R_4;$	$1; -i, 1;$		
$U;$	$\text{XU};$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
			$R_4;$	$1; -i, 1;$		
$Q;$	$\text{RW};$	$\bar{E}, \mathcal{T}\sigma_y;$	$R_2;$	$1; -1, 1;$		

SG 45

 $\Gamma_o^v; \{C_{2z}|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma\Lambda/\Gamma X};$	
$X;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XG};$	
$R;$	$(\frac{1}{2}00);$	$\sigma_y, \bar{E}, \mathcal{T};$	$\{R_5, R_5\};$	$2;$	$\sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{RW};$	
			$\{R_7, R_7\};$	$2;$	$-\sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{RW};$	
$S;$	$(\frac{1}{2}0\frac{1}{2});$	$\sigma_x, \bar{E}, \mathcal{T};$	$\{R_5, R_5\};$	$2;$	$\sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{SW};$	
			$\{R_7, R_7\};$	$2;$	$-\sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{SW};$	
$T;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, -i\sigma_2;$	C-1 WP;	1
$W;$	$(\frac{3}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, \mathcal{T}\sigma_x;$	$\{R_2, R_2\};$	$2;$	$i\sigma_0, -i\sigma_2;$	P-WNLs;	
			$\{R_4, R_4\};$	$2;$	$-i\sigma_0, -i\sigma_2;$	P-WNLs;	
$\Lambda;$	$\Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y;$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$G;$	$XG;$	$C_{2z}, \sigma_y;$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$P;$	$TW;$	$C_{2z};$	$R_2;$	$1;$	$i;$		
			$R_4;$	$1;$	$-i;$		
$\Sigma;$	$\Gamma\Sigma/\Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1;$	$i, 1;$		
			$R_4;$	$1;$	$-i, 1;$		
$F;$	$XF;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1;$	$i, 1;$		
			$R_4;$	$1;$	$-i, 1;$		
$D;$	$SW;$	$\bar{E}, \mathcal{T}\sigma_x;$	$\{R_2, R_2\};$	$2;$	$-\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$\Delta;$	$\Gamma\Delta/\Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1;$	$i, 1;$		
			$R_4;$	$1;$	$-i, 1;$		
$U;$	$XU;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1;$	$i, 1;$		
			$R_4;$	$1;$	$-i, 1;$		
$Q;$	$RW;$	$\bar{E}, \mathcal{T}\sigma_y;$	$\{R_2, R_2\};$	$2;$	$-\sigma_0, -i\sigma_2;$	WNL;	$\pi$

SG 46

 $\Gamma_o^v; \{C_{2z}|000\}, \{\sigma_y|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{\Gamma\Lambda/\Gamma X};$	
$X; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{XG};$	
$R; (\frac{1}{2}00);$	$\sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	$\text{P-WNL};$	
$S; (\frac{1}{2}0\frac{1}{2});$	$\sigma_x, \bar{E}, \mathcal{T};$	$\{R_5, R_5\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$	$\text{P-WNL}_{SW};$	
		$\{R_7, R_7\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$	$\text{P-WNL}_{SW};$	
$T; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	$\text{C-1 WP};$	1
$W; (\frac{3}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	$\text{P-WNL}_{SW};$	
$\Lambda; \Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$
$G; XG;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$
$P; \text{TW};$	$C_{2z};$	$R_2;$	$1; i;$		
		$R_4;$	$1; -i;$		
$\Sigma; \Gamma\Sigma/\Gamma X;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$F; \text{XF};$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; -i, 1;$		
		$R_4;$	$1; i, 1;$		
$D; \text{SW};$	$\bar{E}, \mathcal{T}\sigma_x;$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	$\text{WNL};$	$\pi$
$\Delta; \Gamma\Delta/\Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$U; \text{XU};$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$Q; \text{RW};$	$\bar{E}, \mathcal{T}\sigma_y;$	$R_2;$	$1; -1, 1;$		

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|000\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10}; 2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Y; (\bar{1}\frac{1}{2}00);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10}; 2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$X; (0\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10}; 2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10}; 2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10}; 2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$T; (\bar{1}\frac{1}{2}0\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10}; 2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$S; (\bar{1}\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10}; 2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$R; (\bar{1}\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10}; 2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$D; X S;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$P; U R;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$B; Z T;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$C; Y S;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$E; T R;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$A; Z U;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$H; Y T;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$Q; S R;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$G; X U;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Y; (\frac{1}{2}00);$	$\sigma_z, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$X; (0\frac{1}{2}0);$	$\sigma_y, \sigma_x, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$Z; (00\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_z, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$T; (\frac{1}{2}0\frac{1}{2});$	$\sigma_y, \sigma_x, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$S; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$D; X S;$	$\sigma_x, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$P; U R;$	$C_{2y}, \sigma_z, I\mathcal{T};$	$R_9;$	$2; i\sigma_3, -\sigma_1, -i\sigma_2;$
$B; Z T;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$C; Y S;$	$\sigma_y, C_{2x}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; -i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; -i\sigma_3, -i\sigma_0, -i\sigma_2;$
$E; T R;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_9;$	$2; i\sigma_3, \sigma_1, -i\sigma_2;$
$A; Z U;$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_7\};$	$2; i\sigma_3, \sigma_3, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_3, -i\sigma_2;$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$H; Y T;$	$\sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; -i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; -i\sigma_3, -i\sigma_0, -i\sigma_2;$
$Q; S R;$	$C_{2z}, \sigma_x, I\mathcal{T};$	$R_9;$	$2; i\sigma_3, \sigma_1, -i\sigma_2;$
$G; X U;$	$\sigma_x, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$

SG 49

 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Y; (\frac{1}{2}00);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$X; (0\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Z; (00\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$T; (\frac{1}{2}0\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$S; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$D; XS;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$P; UR;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$B; ZT;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$C; YS;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$E; TR;$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_7\};$	$2; i\sigma_3, \sigma_3, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_3, -i\sigma_2;$
$A; ZU;$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_7\};$	$2; i\sigma_3, \sigma_3, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_3, -i\sigma_2;$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$H; YT;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$Q; SR;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$G; XU;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Y; (\frac{1}{2}00);$	$\sigma_z, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$X; (0\frac{1}{2}0);$	$\sigma_z, \sigma_x, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_z, \sigma_x, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$T; (\frac{1}{2}0\frac{1}{2});$	$\sigma_z, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$S; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$D; XS;$	$\sigma_x, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$P; UR;$	$\sigma_x, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$B; ZT;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$C; YS;$	$\sigma_y, C_{2x}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; -i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; -i\sigma_3, -i\sigma_0, -i\sigma_2;$
$E; TR;$	$\sigma_y, C_{2x}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; -i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; -i\sigma_3, -i\sigma_0, -i\sigma_2;$
$A; ZU;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$H; YT;$	$\sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; -i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; -i\sigma_3, -i\sigma_0, -i\sigma_2;$
$Q; SR;$	$C_{2z}, \sigma_x, I\mathcal{T};$	$R_9;$	$2; i\sigma_3, \sigma_1, -i\sigma_2;$
$G; XU;$	$\sigma_x, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$

## SG 51

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 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Y; (\bar{1}00);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$X; (0\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>ZU</sub> ;	
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>ZU</sub> ;	
$T; (\bar{1}0\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>TR</sub> ;	
$S; (\bar{1}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$R; (\bar{1}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>TR</sub> ;	
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$D; X S;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$P; U R;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; -i\sigma_0, -i\sigma_3, -i\sigma_2;$		
$B; Z T;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; -i\sigma_0, -i\sigma_3, -i\sigma_2;$		
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$C; Y S;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$E; T R;$	$\sigma_y, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$A; Z U;$	$\sigma_y, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$H; Y T;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$Q; S R;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$G; X U;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		



$\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Y; (\bar{1}\frac{1}{2}00);$	$\sigma_z, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$X; (0\frac{1}{2}0);$	$\sigma_y, \sigma_x, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$Z; (00\frac{1}{2});$	$\sigma_x, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>ZU</sub> ;	
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2y}, \sigma_z, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
		$\{R_{10}, R_{10}\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
$T; (\bar{1}\frac{1}{2}0\frac{1}{2});$	$\sigma_z, \sigma_y, I, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, \sigma_0, -i\sigma_2;$		
		$\{R_{15}, R_{16}\};$	$2; -\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$		
		$\{R_{17}, R_{18}\};$	$2; \sigma_0, -i\sigma_3, -\sigma_0, -i\sigma_2;$		
$S; (\bar{1}\frac{1}{2}\frac{1}{2}0);$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_y, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>UR</sub> ;	
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$D; X S;$	$\sigma_x, C_{2y}, I, \mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$P; U R;$	$C_{2y}, \sigma_z, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -\Gamma_{0,1}, i\Gamma_{2,0};$	DNL;	0
$B; Z T;$	$\sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; -i\sigma_0, -i\sigma_3, -i\sigma_2;$		
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$C; Y S;$	$\sigma_y, C_{2x}, I, \mathcal{T};$	$\{R_5, R_8\};$	$2; -i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	$2; -i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$E; T R;$	$\sigma_y, \sigma_z, \bar{E}, I, \mathcal{T};$	$\{R_6, R_8\};$	$2; i\sigma_3, \sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_7, R_9\};$	$2; i\sigma_3, -\sigma_0, -\sigma_0, -i\sigma_2;$		
$A; Z U;$	$\sigma_y, \sigma_z, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$H; Y T;$	$\sigma_y, C_{2z}, I, \mathcal{T};$	$\{R_5, R_8\};$	$2; -i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	$2; -i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$Q; S R;$	$C_{2z}, \sigma_x, I, \mathcal{T};$	$R_9;$	$2; i\sigma_3, \sigma_1, -i\sigma_2;$		
$G; X U;$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$		

$\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_{10};$	2;	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$Y; (\frac{1}{2}00);$	$\sigma_z, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$X; (0\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_{10};$	2;	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>ZU</sub> ;
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>ZU</sub> ;
$T; (\frac{1}{2}0\frac{1}{2});$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, \sigma_0, -i\sigma_2;$	
		$\{R_{15}, R_{16}\};$	2;	$-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$	
		$\{R_{17}, R_{18}\};$	2;	$\sigma_0, -i\sigma_3, -\sigma_0, -i\sigma_2;$	
$S; (\frac{1}{2}\frac{1}{2}0);$	$\sigma_z, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, \sigma_0, -i\sigma_2;$	
		$\{R_{15}, R_{16}\};$	2;	$-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$	
		$\{R_{17}, R_{18}\};$	2;	$\sigma_0, -i\sigma_3, -\sigma_0, -i\sigma_2;$	
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$D; X S;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$P; U R;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$	
$B; Z T;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$	
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$C; Y S;$	$\sigma_y, C_{2x}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$-i\sigma_3, i\sigma_0, -i\sigma_2;$	
		$\{R_6, R_7\};$	2;	$-i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$E; T R;$	$\sigma_y, C_{2x}, \bar{E}, I\mathcal{T};$	$\{R_6, R_9\};$	2;	$i\sigma_3, -i\sigma_3, -\sigma_0, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$i\sigma_3, i\sigma_3, -\sigma_0, -i\sigma_2;$	
$A; Z U;$	$\sigma_y, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL; 0
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$H; Y T;$	$\sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$-i\sigma_3, i\sigma_0, -i\sigma_2;$	
		$\{R_6, R_7\};$	2;	$-i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$Q; S R;$	$\sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$-i\sigma_3, i\sigma_0, -i\sigma_2;$	
		$\{R_6, R_7\};$	2;	$-i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$G; X U;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	

$\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|0\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Y; (\bar{1}\frac{1}{2}00);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$X; (0\frac{1}{2}0);$	$\sigma_y, \sigma_x, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>ZU</sub> ;	
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2y}, \sigma_z, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
		$\{R_{10}, R_{10}\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
$T; (\bar{1}\frac{1}{2}0\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>TR</sub> ;	
$S; (\bar{1}\frac{1}{2}\frac{1}{2}0);$	$\sigma_y, \sigma_x, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$R; (\bar{1}\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2y}, \sigma_z, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
		$\{R_{10}, R_{10}\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$D; X S;$	$\sigma_x, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$P; U R;$	$C_{2y}, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -\Gamma_{0,1}, i\Gamma_{2,0};$	DNL;	0
$B; Z T;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; -i\sigma_0, -i\sigma_3, -i\sigma_2;$		
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$C; Y S;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$E; T R;$	$\sigma_y, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$A; Z U;$	$\sigma_y, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$H; Y T;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$Q; S R;$	$\sigma_x, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$G; X U;$	$\sigma_x, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$		

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{2z}, C_{2y}, I, \mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, \sigma_0, i\sigma_2$ ;		
		$R_{10}$ ;	2;	$i\sigma_2, i\sigma_1, -\sigma_0, i\sigma_2$ ;		
$Y$ ; ( $\frac{1}{2}00$ );	$\sigma_x, C_{2z}, I, \mathcal{T}$ ;	$\{R_{13}, R_{14}\}$ ;	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, i\Gamma_{2,0}$ ;	P-DNL <sub>YS</sub> ;	
$X$ ; ( $0\frac{1}{2}0$ );	$\sigma_y, C_{2z}, I, \mathcal{T}$ ;	$\{R_{13}, R_{14}\}$ ;	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, i\Gamma_{2,0}$ ;	P-DNL <sub>XS</sub> ;	
$Z$ ; ( $00\frac{1}{2}$ );	$C_{2z}, C_{2y}, I, \mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, \sigma_0, i\sigma_2$ ;		
		$R_{10}$ ;	2;	$i\sigma_2, i\sigma_1, -\sigma_0, i\sigma_2$ ;		
$U$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$\sigma_y, C_{2z}, I, \mathcal{T}$ ;	$\{R_{13}, R_{14}\}$ ;	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, i\Gamma_{2,0}$ ;	P-DNL <sub>UR</sub> ;	
$T$ ; ( $\frac{1}{2}0\frac{1}{2}$ );	$\sigma_x, C_{2z}, I, \mathcal{T}$ ;	$\{R_{13}, R_{14}\}$ ;	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, i\Gamma_{2,0}$ ;	P-DNL <sub>TR</sub> ;	
$S$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$C_{2z}, C_{2x}, I, \mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, \Gamma_{0,0}, \Gamma_{2,1}$ ;	P-DNLs;	
		$\{R_{19}, R_{19}\}$ ;	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{2,1}$ ;	P-DNLs;	
$R$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{2z}, C_{2x}, I, \mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, \Gamma_{0,0}, \Gamma_{2,1}$ ;	P-DNLs;	
		$\{R_{19}, R_{19}\}$ ;	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{2,1}$ ;	P-DNLs;	
$\Delta$ ; $\Gamma Y$ ;	$C_{2y}, \sigma_x, I\mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, -i\sigma_2$ ;		
$D$ ; $XS$ ;	$\sigma_z, \sigma_x, I\mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, \Gamma_{2,1}$ ;	DNL;	0
$P$ ; $UR$ ;	$\sigma_z, \sigma_x, I\mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, \Gamma_{2,1}$ ;	DNL;	0
$B$ ; $ZT$ ;	$C_{2y}, \sigma_x, I\mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, i\sigma_2$ ;		
$\Sigma$ ; $\Gamma X$ ;	$C_{2x}, \sigma_y, I\mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, i\sigma_2$ ;		
$C$ ; $YS$ ;	$\sigma_z, C_{2x}, I\mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$i\Gamma_{0,3}, i\Gamma_{0,1}, \Gamma_{2,1}$ ;	DNL;	0
$E$ ; $TR$ ;	$\sigma_z, C_{2x}, I\mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$i\Gamma_{0,3}, i\Gamma_{0,1}, \Gamma_{2,1}$ ;	DNL;	0
$A$ ; $ZU$ ;	$C_{2x}, \sigma_y, I\mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, i\sigma_2$ ;		
$\Lambda$ ; $\Gamma Z$ ;	$C_{2z}, \sigma_y, I\mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, i\sigma_2$ ;		
$H$ ; $YT$ ;	$\sigma_y, C_{2z}, I\mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2;	$-i\sigma_0, i\sigma_3, i\sigma_2$ ;		
		$\{R_7, R_8\}$ ;	2;	$i\sigma_0, -i\sigma_3, i\sigma_2$ ;		
$Q$ ; $SR$ ;	$C_{2z}, \sigma_x, I\mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, \Gamma_{2,1}$ ;	DNL;	0
$G$ ; $XU$ ;	$\sigma_x, C_{2z}, I\mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2;	$i\sigma_0, i\sigma_3, i\sigma_2$ ;		
		$\{R_7, R_8\}$ ;	2;	$-i\sigma_0, -i\sigma_3, i\sigma_2$ ;		

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	2;	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Y; (\bar{1}00);$	$\sigma_z, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>YT</sub> ;	
$X; (0\frac{1}{2}0);$	$\sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XU</sub> ;	
$Z; (00\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_x, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
		$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
$T; (\bar{1}0\frac{1}{2});$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
		$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
$S; (\bar{1}\frac{1}{2}0);$	$C_{2y}, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>SR</sub> ;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2x}, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, \Gamma_{0,0}, -\Gamma_{2,1};$	P-DNLs;	
		$\{R_{19}, R_{19}\};$	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{0,0}, -\Gamma_{2,1};$	P-DNLs;	
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$D; X S;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$P; U R;$	$\sigma_x, C_{2y}, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$\Gamma_{0,3}, -i\Gamma_{0,1}, i\Gamma_{2,0};$	DNL;	0
$B; Z T;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$C; Y S;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, -\sigma_3, -i\sigma_2;$		
		$\{R_6, R_8\};$	2;	$-i\sigma_3, \sigma_3, -i\sigma_2;$		
$E; T R;$	$\sigma_y, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,3};$	DNL;	0
$A; Z U;$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_7\};$	2;	$i\sigma_3, \sigma_3, -i\sigma_2;$		
		$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_3, -i\sigma_2;$		
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$H; Y T;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	4;	$i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$Q; S R;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	4;	$i\Gamma_{0,2}, i\Gamma_{0,1}, i\Gamma_{2,0};$	DNL;	0
$G; X U;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	4;	$i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,3};$	DNL;	0

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|0\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Y; (\frac{1}{2}00);$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>YS</sub> ;	
$X; (0\frac{1}{2}0);$	$\sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XU</sub> ;	
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XU</sub> ;	
$T; (\frac{1}{2}0\frac{1}{2});$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>TR</sub> ;	
$S; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2x}, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>YS</sub> ;	
		$\{R_{10}, R_{10}\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>YS</sub> ;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2x}, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>TR</sub> ;	
		$\{R_{10}, R_{10}\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>TR</sub> ;	
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$D; X S;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$P; U R;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$B; Z T;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$C; Y S;$	$\sigma_z, C_{2x}, I\mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$E; T R;$	$\sigma_z, C_{2x}, I\mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$A; Z U;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$H; Y T;$	$\sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_6\};$	$2; -i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; i\sigma_0, -i\sigma_3, -i\sigma_2;$		
$Q; S R;$	$\sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_5\};$	$2; -i\sigma_0, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_6\};$	$2; -i\sigma_0, -i\sigma_0, -i\sigma_2;$		
		$\{R_7, R_7\};$	$2; i\sigma_0, -i\sigma_0, -i\sigma_2;$		
		$\{R_8, R_8\};$	$2; i\sigma_0, i\sigma_0, -i\sigma_2;$		
$G; X U;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	$4; i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,3};$	DNL;	0

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|00\frac{1}{2}\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000); $C_{2z}, C_{2y}, I, \mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2$ ; $R_{10}$ ; 2; $i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2$ ;	
$Y$ ; ( $\frac{1}{2}00$ ); $\sigma_x, C_{2z}, I, \mathcal{T}$ ; $\{R_{13}, R_{14}\}$ ; 4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; P-DNL <sub>YS</sub> ;	
$X$ ; ( $0\frac{1}{2}0$ ); $\sigma_y, C_{2z}, I, \mathcal{T}$ ; $\{R_{13}, R_{14}\}$ ; 4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; P-DNL <sub>XS</sub> ;	
$Z$ ; ( $00\frac{1}{2}$ ); $\sigma_x, \sigma_z, I, \mathcal{T}$ ; $\{R_{13}, R_{14}\}$ ; 4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; DP; 0	
$U$ ; ( $0\frac{1}{2}\frac{1}{2}$ ); $\sigma_x, C_{2z}, I, \mathcal{T}$ ; $\{R_5, R_6\}$ ; 2; $-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2$ ; $\{R_7, R_8\}$ ; 2; $\sigma_0, -i\sigma_3, \sigma_0, -i\sigma_2$ ; $\{R_{15}, R_{16}\}$ ; 2; $-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2$ ; $\{R_{17}, R_{18}\}$ ; 2; $\sigma_0, -i\sigma_3, -\sigma_0, -i\sigma_2$ ;	
$T$ ; ( $\frac{1}{2}0\frac{1}{2}$ ); $\sigma_y, C_{2z}, I, \mathcal{T}$ ; $\{R_5, R_6\}$ ; 2; $-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2$ ; $\{R_7, R_8\}$ ; 2; $\sigma_0, -i\sigma_3, \sigma_0, -i\sigma_2$ ; $\{R_{15}, R_{16}\}$ ; 2; $-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2$ ; $\{R_{17}, R_{18}\}$ ; 2; $\sigma_0, -i\sigma_3, -\sigma_0, -i\sigma_2$ ;	
$S$ ; ( $\frac{1}{2}\frac{1}{2}0$ ); $C_{2z}, \sigma_x, I, \mathcal{T}$ ; $\{R_9, R_9\}$ ; 4; $i\Gamma_{0,3}, \Gamma_{0,1}, \Gamma_{0,0}, -\Gamma_{2,1}$ ; P-DNLs; $\{R_{19}, R_{19}\}$ ; 4; $i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{0,0}, -\Gamma_{2,1}$ ; P-DNLs;	
$R$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $C_{2y}, \sigma_z, I, \mathcal{T}$ ; $\{R_{13}, R_{14}\}$ ; 4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; P-DNL <sub>SR</sub> ;	
$\Delta$ ; $\Gamma_Y$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	
$D$ ; XS; $\sigma_z, \sigma_x, I\mathcal{T}$ ; $\{R_9, R_9\}$ ; 4; $i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1}$ ; DNL; 0	
$P$ ; UR; $C_{2y}, \sigma_x, \bar{E}, I\mathcal{T}$ ; $\{R_6, R_8\}$ ; 2; $-i\sigma_3, -\sigma_0, -\sigma_0, -i\sigma_2$ ; $\{R_7, R_9\}$ ; 2; $-i\sigma_3, \sigma_0, -\sigma_0, -i\sigma_2$ ;	
$B$ ; ZT; $\sigma_z, C_{2y}, I\mathcal{T}$ ; $\{R_5, R_8\}$ ; 2; $i\sigma_3, i\sigma_0, -i\sigma_2$ ; $\{R_6, R_7\}$ ; 2; $i\sigma_3, -i\sigma_0, -i\sigma_2$ ;	
$\Sigma$ ; $\Gamma_X$ ; $C_{2x}, \sigma_y, I\mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	
$C$ ; YS; $\sigma_z, C_{2x}, I\mathcal{T}$ ; $\{R_9, R_9\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{0,1}, -\Gamma_{2,1}$ ; DNL; 0	
$E$ ; TR; $C_{2x}, \sigma_z, \bar{E}, I\mathcal{T}$ ; $\{R_6, R_9\}$ ; 2; $i\sigma_3, -i\sigma_3, -\sigma_0, -i\sigma_2$ ; $\{R_7, R_8\}$ ; 2; $i\sigma_3, i\sigma_3, -\sigma_0, -i\sigma_2$ ;	
$A$ ; ZU; $\sigma_z, \sigma_y, I\mathcal{T}$ ; $\{R_5, R_7\}$ ; 2; $i\sigma_3, \sigma_3, -i\sigma_2$ ; $\{R_6, R_8\}$ ; 2; $i\sigma_3, -\sigma_3, -i\sigma_2$ ;	
$\Lambda$ ; $\Gamma_Z$ ; $C_{2z}, \sigma_y, I\mathcal{T}$ ; $R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	
$H$ ; YT; $\sigma_y, C_{2z}, I\mathcal{T}$ ; $\{R_5, R_6\}$ ; 2; $-i\sigma_0, i\sigma_3, -i\sigma_2$ ; $\{R_7, R_8\}$ ; 2; $i\sigma_0, -i\sigma_3, -i\sigma_2$ ;	
$Q$ ; SR; $C_{2z}, \sigma_x, I\mathcal{T}$ ; $\{R_9, R_9\}$ ; 4; $i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1}$ ; DNL; 0	
$G$ ; XU; $\sigma_x, C_{2z}, I\mathcal{T}$ ; $\{R_5, R_6\}$ ; 2; $i\sigma_0, i\sigma_3, -i\sigma_2$ ; $\{R_7, R_8\}$ ; 2; $-i\sigma_0, -i\sigma_3, -i\sigma_2$ ;	

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Y; (\frac{1}{2}00);$	$\sigma_z, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>YT</sub> ;	
$X; (0\frac{1}{2}0);$	$\sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XU</sub> ;	
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XU</sub> ;	
$T; (\frac{1}{2}0\frac{1}{2});$	$\sigma_z, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>YT</sub> ;	
$S; (\frac{1}{2}\frac{1}{2}0);$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>SR</sub> ;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>SR</sub> ;	
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$D; XS;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$P; UR;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$B; ZT;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$C; YS;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_3, -i\sigma_2;$		
		$\{R_6, R_8\};$	$2; -i\sigma_3, \sigma_3, -i\sigma_2;$		
$A; TR;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$		
$E; ZU;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; -\sigma_2, i\sigma_1, -i\sigma_1;$		
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$H; YT;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	$4; i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$Q; SR;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	$4; i\Gamma_{0,2}, i\Gamma_{0,1}, i\Gamma_{2,0};$	DNL;	0
$G; XU;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	$4; i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,3};$	DNL;	0



$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}0\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, \sigma_0, i\sigma_2;$		
		$R_{10};$	2;	$i\sigma_2, i\sigma_1, -\sigma_0, i\sigma_2;$		
$Y; (\frac{1}{2}00);$	$\sigma_z, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>YT</sub> ;	
$X; (0\frac{1}{2}0);$	$\sigma_y, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>XS</sub> ;	
$Z; (00\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP;	0
$U; (0\frac{1}{2}\frac{1}{2});$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, \sigma_0, i\sigma_2;$		
		$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, \sigma_0, i\sigma_2;$		
		$\{R_{15}, R_{16}\};$	2;	$-\sigma_0, i\sigma_3, -\sigma_0, i\sigma_2;$		
		$\{R_{17}, R_{18}\};$	2;	$\sigma_0, -i\sigma_3, -\sigma_0, i\sigma_2;$		
$T; (\frac{1}{2}0\frac{1}{2});$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
		$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
$S; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>XS</sub> ;	
		$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>XS</sub> ;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2x}, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>TR</sub> ;	
		$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>TR</sub> ;	
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$D; X S;$	$\sigma_z, \sigma_x, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, \Gamma_{2,1};$	DNL;	0
$P; U R;$	$C_{2y}, \sigma_x, \bar{E}, I, \mathcal{T};$	$\{R_6, R_8\};$	2;	$-i\sigma_3, -\sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_7, R_9\};$	2;	$-i\sigma_3, \sigma_0, -\sigma_0, -i\sigma_2;$		
$B; Z T;$	$\sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$C; Y S;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, -\sigma_3, -i\sigma_2;$		
		$\{R_6, R_8\};$	2;	$-i\sigma_3, \sigma_3, -i\sigma_2;$		
$E; T R;$	$\sigma_y, \sigma_z, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,3};$	DNL;	0
$A; Z U;$	$\sigma_z, \sigma_y, I, \mathcal{T};$	$\{R_5, R_7\};$	2;	$i\sigma_3, \sigma_3, -i\sigma_2;$		
		$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_3, -i\sigma_2;$		
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$H; Y T;$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$\{R_5, R_5\};$	4;	$i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$Q; S R;$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_5, R_5\};$	2;	$i\sigma_0, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_6\};$	2;	$i\sigma_0, -i\sigma_0, -i\sigma_2;$		
		$\{R_7, R_7\};$	2;	$-i\sigma_0, -i\sigma_0, -i\sigma_2;$		
		$\{R_8, R_8\};$	2;	$-i\sigma_0, i\sigma_0, -i\sigma_2;$		
$G; X U;$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$		

## 8. SG 61-70

SG 61

 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Y; (\bar{1}\frac{1}{2}00);$	$\sigma_z, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>YT</sub> ;	
$X; (0\frac{1}{2}0);$	$\sigma_y, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XS</sub> ;	
$Z; (00\frac{1}{2});$	$\sigma_x, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>ZU</sub> ;	
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2y}, C_{2x}, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>ZU</sub> ;	
		$\{R_{10}, R_{10}\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>ZU</sub> ;	
$T; (\bar{1}\frac{1}{2}0\frac{1}{2});$	$C_{2x}, C_{2z}, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>YT</sub> ;	
		$\{R_{10}, R_{10}\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>YT</sub> ;	
$S; (\bar{1}\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>XS</sub> ;	
		$\{R_{10}, R_{10}\};$	$4; i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>XS</sub> ;	
$R; (\bar{1}\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2x}, C_{2y}, \bar{E}, I, \mathcal{T};$	$\{R_6, R_6\};$	$2; \sigma_0, \sigma_0, -\sigma_0, \sigma_0, -i\sigma_2;$		
		$\{R_7, R_7\};$	$2; \sigma_0, -\sigma_0, -\sigma_0, \sigma_0, -i\sigma_2;$		
		$\{R_8, R_8\};$	$2; -\sigma_0, \sigma_0, -\sigma_0, \sigma_0, -i\sigma_2;$		
		$\{R_9, R_9\};$	$2; -\sigma_0, -\sigma_0, -\sigma_0, \sigma_0, -i\sigma_2;$		
		$\{R_{16}, R_{16}\};$	$2; \sigma_0, \sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_{17}, R_{17}\};$	$2; \sigma_0, -\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_{18}, R_{18}\};$	$2; -\sigma_0, \sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_{19}, R_{19}\};$	$2; -\sigma_0, -\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$		
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$D; X S;$	$\sigma_z, \sigma_x, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$P; U R;$	$C_{2y}, \sigma_x, \bar{E}, I, \mathcal{T};$	$\{R_6, R_6\};$	$2; -i\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_7, R_7\};$	$2; -i\sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_8, R_8\};$	$2; i\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_9, R_9\};$	$2; i\sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$		
$B; Z T;$	$\sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; -i\sigma_0, -i\sigma_3, -i\sigma_2;$		
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$C; Y S;$	$\sigma_y, C_{2x}, I, \mathcal{T};$	$\{R_5, R_6\};$	$2; -i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; i\sigma_0, -i\sigma_3, -i\sigma_2;$		
$E; T R;$	$C_{2x}, \sigma_z, \bar{E}, I, \mathcal{T};$	$\{R_6, R_6\};$	$2; -i\sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_7, R_7\};$	$2; -i\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_8, R_8\};$	$2; i\sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_9, R_9\};$	$2; i\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$		
$A; Z U;$	$\sigma_y, \sigma_z, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$H; Y T;$	$\sigma_x, \sigma_y, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$Q; S R;$	$C_{2z}, \sigma_y, \bar{E}, I, \mathcal{T};$	$\{R_6, R_6\};$	$2; i\sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_7, R_7\};$	$2; i\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_8, R_8\};$	$2; -i\sigma_0, \sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_9, R_9\};$	$2; -i\sigma_0, -\sigma_0, -\sigma_0, -i\sigma_2;$		
$G; X U;$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; -i\sigma_0, -i\sigma_3, -i\sigma_2;$		

$\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	2;	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Y; (\bar{1}00);$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>YS</sub> ;	
$X; (0\frac{1}{2}0);$	$\sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XU</sub> ;	
$Z; (00\frac{1}{2});$	$\sigma_x, C_{2y}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>ZU</sub> ;	
$U; (0\frac{1}{2}\frac{1}{2});$	$C_{2y}, C_{2z}, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, \Gamma_{0,0}, -\Gamma_{2,1};$	P-DNLs;	
		$\{R_{19}, R_{19}\};$	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{0,0}, -\Gamma_{2,1};$	P-DNLs;	
$T; (\bar{1}0\frac{1}{2});$	$C_{2y}, \sigma_x, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>TR</sub> ;	
$S; (\bar{1}\frac{1}{2}0);$	$\sigma_y, C_{2x}, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>YS</sub> ;	
		$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL <sub>YS</sub> ;	
$R; (\bar{1}\frac{1}{2}\frac{1}{2});$	$\sigma_y, \sigma_z, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
		$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
$\Delta; \Gamma Y;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$D; X S;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$P; U R;$	$\sigma_x, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$\Gamma_{0,3}, -\Gamma_{0,1}, i\Gamma_{2,0};$	DNL;	0
$B; Z T;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$		
$\Sigma; \Gamma X;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$C; Y S;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	4;	$i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$E; T R;$	$\sigma_y, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, i\Gamma_{2,0};$	DNL;	0
$A; Z U;$	$\sigma_y, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$H; Y T;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$-i\sigma_3, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_7\};$	2;	$-i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$Q; S R;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	2;	$-i\sigma_0, i\sigma_0, -i\sigma_2;$		
		$\{R_6, R_6\};$	2;	$-i\sigma_0, -i\sigma_0, -i\sigma_2;$		
		$\{R_7, R_7\};$	2;	$i\sigma_0, -i\sigma_0, -i\sigma_2;$		
		$\{R_8, R_8\};$	2;	$i\sigma_0, i\sigma_0, -i\sigma_2;$		
$G; X U;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	4;	$i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,3};$	DNL;	0

SG 63

 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>ZB</sub> ;	
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>TG</sub> ;	
$S; (0\frac{1}{2}0);$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$		
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$		
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL;	
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$H; Y\mathcal{T};$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$D; \text{SR};$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$		
$A; Z\mathcal{T};$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, \sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; -i\sigma_0, -\sigma_3, -i\sigma_2;$		
$\Sigma; \Gamma Y;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$\Delta; \Gamma \Delta;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$B; ZB;$	$\sigma_x, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$G; TG;$	$\sigma_x, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$F; YF;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$E; TE;$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, \sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; -i\sigma_0, -\sigma_3, -i\sigma_2;$		
$C; YC;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		

SG 64

 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>ZB</sub> ;	
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>TG</sub> ;	
$S; (0\frac{1}{2}0);$	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$R; (0\frac{1}{2}\frac{1}{2});$	$\sigma_z, I, \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, \sigma_0, -i\sigma_2;$		
		$\{R_3, R_3\};$	$2; -\sigma_0, \sigma_0, -i\sigma_2;$		
		$\{R_5, R_5\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$		
		$\{R_7, R_7\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$		
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$H; Y\mathcal{T};$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, -i\sigma_1, -i\sigma_2;$		
$D; SR;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$		
		$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$		
$A; Z\mathcal{T};$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, \sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; -i\sigma_0, -\sigma_3, -i\sigma_2;$		
$\Sigma; \Gamma Y;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$\Delta; \Gamma\Delta;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		
$B; ZB;$	$\sigma_x, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$G; TG;$	$\sigma_x, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	$4; -i\Gamma_{0,3}, i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$F; YF;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, -i\sigma_1, -i\sigma_2;$		
$E; TE;$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, \sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	$2; -i\sigma_0, -\sigma_3, -i\sigma_2;$		
$C; YC;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$		

SG 65

 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$S; (0\frac{1}{2}0);$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$H; Y\mathcal{T};$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$D; \text{SR};$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$
$A; Z\mathcal{T};$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Sigma; \Gamma Y;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Delta; \Gamma\Delta;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$B; ZB;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$G; \text{TG};$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$F; YF;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$E; \text{TE};$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$C; YC;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$

SG 66

 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Z; (00\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$S; (0\frac{1}{2}0);$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$H; Y\Gamma;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$D; \text{SR};$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$
$A; Z\Gamma;$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_7\};$	$2; i\sigma_3, \sigma_3, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_3, -i\sigma_2;$
$\Sigma; \Gamma Y;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Delta; \Gamma\Delta;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$B; ZB;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$G; \text{TG};$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$F; YF;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$E; \text{TE};$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_7\};$	$2; i\sigma_3, \sigma_3, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_3, -i\sigma_2;$
$C; YC;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$

SG 67

 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Z; (00\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$S; (0\frac{1}{2}0);$	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$R; (0\frac{1}{2}\frac{1}{2});$	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$H; Y\mathcal{T};$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, -i\sigma_1, -i\sigma_2;$
$D; SR;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$
		$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$
$A; Z\mathcal{T};$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Sigma; \Gamma Y;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Delta; \Gamma\Delta;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$B; ZB;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$G; TG;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, -i\sigma_1, -i\sigma_2;$
$F; YF;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, -i\sigma_1, -i\sigma_2;$
$E; TE;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$C; YC;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$



SG 68

 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Y; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Z; (00\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$T; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$S; (0\frac{1}{2}0);$	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$R; (0\frac{1}{2}\frac{1}{2});$	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$\Lambda; \Gamma Z;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$H; Y\mathcal{T};$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, -i\sigma_1, -i\sigma_2;$
$D; \text{SR};$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$
		$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$
$A; Z\mathcal{T};$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_7\};$	$2; i\sigma_3, \sigma_3, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_3, -i\sigma_2;$
$\Sigma; \Gamma Y;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Delta; \Gamma \Delta;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$B; ZB;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$G; \text{TG};$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; -i\sigma_3, i\sigma_0, -i\sigma_2;$
		$\{R_6, R_7\};$	$2; -i\sigma_3, -i\sigma_0, -i\sigma_2;$
$F; YF;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, -i\sigma_1, -i\sigma_2;$
$E; \text{TE};$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_7\};$	$2; i\sigma_3, \sigma_3, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_3, -i\sigma_2;$
$C; YC;$	$C_{2x}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$

SG 69

 $\Gamma_o^f$ ;  $\{C_{2z}|000\}$ ,  $\{C_{2y}|000\}$ ,  $\{I|000\}$ ,  $\mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{2z}, C_{2y}, I, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2$ ;
	$R_{10}$ ;	2; $i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2$ ;
$Y$ ; $(0\frac{1}{2}\frac{1}{2})$ ;	$C_{2z}, C_{2y}, I, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2$ ;
	$R_{10}$ ;	2; $i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2$ ;
$X$ ; $(\frac{1}{2}0\frac{1}{2})$ ;	$C_{2z}, C_{2y}, I, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2$ ;
	$R_{10}$ ;	2; $i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2$ ;
$Z$ ; $(\frac{1}{2}\frac{1}{2}0)$ ;	$C_{2z}, C_{2y}, I, \mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2$ ;
	$R_{10}$ ;	2; $i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2$ ;
$L$ ; $(\frac{1}{2}00)$ ;	$I, \bar{E}, \mathcal{T}$ ;	$\{R_2, R_2\}$ ; 2; $\sigma_0, -\sigma_0, -i\sigma_2$ ;
		$\{R_4, R_4\}$ ; 2; $-\sigma_0, -\sigma_0, -i\sigma_2$ ;
$\Lambda$ ; $\Gamma Z/\Gamma\Lambda$ ;	$C_{2z}, \sigma_y, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$G$ ; $XG/XY$ ;	$C_{2z}, \sigma_y, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$H$ ; $YH/YX$ ;	$C_{2z}, \sigma_y, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$Q$ ; $ZQ$ ;	$C_{2z}, \sigma_y, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$\Sigma$ ; $\Gamma X/\Gamma\Sigma$ ;	$C_{2x}, \sigma_z, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$C$ ; $YC/YZ$ ;	$C_{2x}, \sigma_z, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$A$ ; $ZA/ZY$ ;	$C_{2x}, \sigma_z, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$U$ ; $XU$ ;	$C_{2x}, \sigma_z, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$\Delta$ ; $\Gamma Y/\Gamma\Delta$ ;	$C_{2y}, \sigma_x, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$D$ ; $XD/XZ$ ;	$C_{2y}, \sigma_x, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$B$ ; $ZB/ZX$ ;	$C_{2y}, \sigma_x, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$R$ ; $YR$ ;	$C_{2y}, \sigma_x, I\mathcal{T}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;

$\Gamma_o^f; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{2z}, C_{2y}, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2$ ;
		$R_{10}$ ;	2; $i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2$ ;
$Y$ ; $(0\frac{1}{2}\frac{1}{2})$ ;	$\sigma_x, \sigma_y, I, \mathcal{T}$ ;	$\{R_{13}, R_{14}\}$ ;	4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; DP; 0
$X$ ; $(\frac{1}{2}0\frac{1}{2})$ ;	$\sigma_z, \sigma_x, I, \mathcal{T}$ ;	$\{R_{13}, R_{14}\}$ ;	4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; DP; 0
$Z$ ; $(\frac{1}{2}\frac{1}{2}0)$ ;	$\sigma_y, \sigma_z, I, \mathcal{T}$ ;	$\{R_{13}, R_{14}\}$ ;	4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; DP; 0
$L$ ; $(\frac{1}{2}00)$ ;	$I, \bar{E}, \mathcal{T}$ ;	$\{R_2, R_2\}$ ;	2; $\sigma_0, -\sigma_0, -i\sigma_2$ ;
		$\{R_4, R_4\}$ ;	2; $-\sigma_0, -\sigma_0, -i\sigma_2$ ;
$\Lambda$ ; $\Gamma_Z/\Gamma_\Lambda$ ;	$C_{2z}, \sigma_y, I\mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$G$ ; $XG/XY$ ;	$\sigma_x, C_{2z}, I\mathcal{T}$ ;	$\{R_5, R_8\}$ ;	2; $i\sigma_3, i\sigma_0, -i\sigma_2$ ;
		$\{R_6, R_7\}$ ;	2; $i\sigma_3, -i\sigma_0, -i\sigma_2$ ;
$H$ ; $YH/YX$ ;	$\sigma_y, C_{2z}, I\mathcal{T}$ ;	$\{R_5, R_8\}$ ;	2; $-i\sigma_3, i\sigma_0, -i\sigma_2$ ;
		$\{R_6, R_7\}$ ;	2; $-i\sigma_3, -i\sigma_0, -i\sigma_2$ ;
$Q$ ; $ZQ$ ;	$C_{2z}, \sigma_x, I\mathcal{T}$ ;	$R_9$ ;	2; $i\sigma_3, \sigma_1, -i\sigma_2$ ;
$\Sigma$ ; $\Gamma_X/\Gamma_\Sigma$ ;	$C_{2x}, \sigma_z, I\mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$C$ ; $YC/YZ$ ;	$\sigma_y, C_{2x}, I\mathcal{T}$ ;	$\{R_5, R_8\}$ ;	2; $-i\sigma_3, i\sigma_0, -i\sigma_2$ ;
		$\{R_6, R_7\}$ ;	2; $-i\sigma_3, -i\sigma_0, -i\sigma_2$ ;
$A$ ; $ZA/ZY$ ;	$\sigma_z, \sigma_y, I\mathcal{T}$ ;	$\{R_5, R_7\}$ ;	2; $i\sigma_3, \sigma_3, -i\sigma_2$ ;
		$\{R_6, R_8\}$ ;	2; $i\sigma_3, -\sigma_3, -i\sigma_2$ ;
$U$ ; $XU$ ;	$C_{2x}, \sigma_y, I\mathcal{T}$ ;	$R_9$ ;	2; $i\sigma_3, \sigma_1, -i\sigma_2$ ;
$\Delta$ ; $\Gamma_Y/\Gamma_\Delta$ ;	$C_{2y}, \sigma_x, I\mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$D$ ; $XD/XZ$ ;	$\sigma_x, C_{2y}, I\mathcal{T}$ ;	$\{R_5, R_8\}$ ;	2; $i\sigma_3, i\sigma_0, -i\sigma_2$ ;
		$\{R_6, R_7\}$ ;	2; $i\sigma_3, -i\sigma_0, -i\sigma_2$ ;
$B$ ; $ZB/ZX$ ;	$\sigma_z, C_{2y}, I\mathcal{T}$ ;	$\{R_5, R_8\}$ ;	2; $i\sigma_3, i\sigma_0, -i\sigma_2$ ;
		$\{R_6, R_7\}$ ;	2; $i\sigma_3, -i\sigma_0, -i\sigma_2$ ;
$R$ ; $YR$ ;	$C_{2y}, \sigma_z, I\mathcal{T}$ ;	$R_9$ ;	2; $i\sigma_3, -\sigma_1, -i\sigma_2$ ;

SG 71

 $\Gamma_o^v; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
			$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$X;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
			$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$R;$	$(\frac{1}{2}00);$	$C_{2y}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$S;$	$(\frac{1}{2}0\frac{1}{2});$	$C_{2x}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$T;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$W;$	$(\frac{3}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, C_{2y}, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Lambda;$	$\Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$G;$	$XG;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$P;$	$TW;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$
$\Sigma;$	$\Gamma\Sigma/\Gamma X;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$F;$	$XF;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$D;$	$SW;$	$C_{2x}, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$
$\Delta;$	$\Gamma\Delta/\Gamma X;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$U;$	$XU;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$Q;$	$RW;$	$C_{2y}, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$

SG 72

 $\Gamma_o^v; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$	
			$R_{10};$	$2;$	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$X;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$	
			$R_{10};$	$2;$	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$R;$	$(\frac{1}{2}00);$	$\sigma_y, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4;$	$\Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$S;$	$(\frac{1}{2}0\frac{1}{2});$	$\sigma_x, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4;$	$\Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$T;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, \sigma_0, -i\sigma_2;$	
			$\{R_6, R_8\};$	$2;$	$i\sigma_3, -\sigma_0, -i\sigma_2;$	
$W;$	$(\frac{3}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, C_{2y}, I\mathcal{T};$	$\{R_5, R_5\};$	$4;$	$i\Gamma_{0,2}, i\Gamma_{0,1}, i\Gamma_{2,0};$	DP; 0
$\Lambda;$	$\Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$G;$	$XG;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$P;$	$TW;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, -i\sigma_2;$	
$\Sigma;$	$\Gamma\Sigma/\Gamma X;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$F;$	$XF;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$D;$	$SW;$	$C_{2x}, I\mathcal{T};$	$\{R_2, R_2\};$	$2;$	$i\sigma_0, -i\sigma_2;$	
			$\{R_4, R_4\};$	$2;$	$-i\sigma_0, -i\sigma_2;$	
$\Delta;$	$\Gamma\Delta/\Gamma X;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$U;$	$XU;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$Q;$	$RW;$	$C_{2y}, I\mathcal{T};$	$\{R_2, R_2\};$	$2;$	$i\sigma_0, -i\sigma_2;$	
			$\{R_4, R_4\};$	$2;$	$-i\sigma_0, -i\sigma_2;$	

$\Gamma_o^v$ ;  $\{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{2z}, C_{2y}, I, \mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2$ ;
		$R_{10}$ ;	2;	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2$ ;
$X$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;	$C_{2z}, C_{2y}, I, \mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2$ ;
		$R_{10}$ ;	2;	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2$ ;
$R$ ; $(\frac{1}{2}00)$ ;	$\sigma_y, E, I, \mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$\Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; DP; 0
$S$ ; $(\frac{1}{2}0\frac{1}{2})$ ;	$\sigma_x, E, I, \mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$\Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; DP; 0
$T$ ; $(\frac{1}{2}\frac{1}{2}0)$ ;	$\sigma_z, E, I, \mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$\Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; DP; 0
$W$ ; $(\frac{3}{4}\frac{1}{4}\frac{1}{4})$ ;	$C_{2x}, C_{2y}, I, \mathcal{T}$ ;	$\{R_1, R_1\}$ ;	2;	$\sigma_0, \sigma_0, -i\sigma_2$ ;
		$\{R_2, R_2\}$ ;	2;	$\sigma_0, -\sigma_0, -i\sigma_2$ ;
		$\{R_3, R_3\}$ ;	2;	$-\sigma_0, \sigma_0, -i\sigma_2$ ;
		$\{R_4, R_4\}$ ;	2;	$-\sigma_0, -\sigma_0, -i\sigma_2$ ;
$\Lambda$ ; $\Gamma\Lambda/\Gamma X$ ;	$C_{2z}, \sigma_y, I, \mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$G$ ; $XG$ ;	$C_{2z}, \sigma_y, I, \mathcal{T}$ ;	$R_5$ ;	2;	$-i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$P$ ; $TW$ ;	$C_{2z}, \bar{E}, I, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2;	$-i\sigma_0, -\sigma_0, -i\sigma_2$ ;
		$\{R_7, R_7\}$ ;	2;	$i\sigma_0, -\sigma_0, -i\sigma_2$ ;
$\Sigma$ ; $\Gamma\Sigma/\Gamma X$ ;	$C_{2x}, \sigma_z, I, \mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$F$ ; $XF$ ;	$C_{2x}, \sigma_z, I, \mathcal{T}$ ;	$R_5$ ;	2;	$-i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$D$ ; $SW$ ;	$C_{2x}, \bar{E}, I, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2;	$i\sigma_0, -\sigma_0, -i\sigma_2$ ;
		$\{R_7, R_7\}$ ;	2;	$-i\sigma_0, -\sigma_0, -i\sigma_2$ ;
$\Delta$ ; $\Gamma\Delta/\Gamma X$ ;	$C_{2y}, \sigma_x, I, \mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$U$ ; $XU$ ;	$C_{2y}, \sigma_x, I, \mathcal{T}$ ;	$R_5$ ;	2;	$i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$Q$ ; $RW$ ;	$C_{2y}, \bar{E}, I, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2;	$-i\sigma_0, -\sigma_0, -i\sigma_2$ ;
		$\{R_7, R_7\}$ ;	2;	$i\sigma_0, -\sigma_0, -i\sigma_2$ ;

SG 74

 $\Gamma_o^v; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
			$R_{10};$	$2;$	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$X;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
			$R_{10};$	$2;$	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$R;$	$(\frac{1}{2}00);$	$C_{2y}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_6, R_8\};$	$2;$	$i\sigma_3, -\sigma_0, -i\sigma_2;$
$S;$	$(\frac{1}{2}0\frac{1}{2});$	$C_{2x}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_6, R_8\};$	$2;$	$i\sigma_3, -\sigma_0, -i\sigma_2;$
$T;$	$(\frac{1}{2}\frac{1}{2}0);$	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4;$	$\Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$W;$	$(\frac{3}{4}\frac{1}{4}\frac{1}{4});$	$C_{2x}, C_{2y}, I, \mathcal{T};$	$\{R_1, R_4\};$	$2;$	$\sigma_3, \sigma_3, -i\sigma_2;$
			$\{R_2, R_3\};$	$2;$	$\sigma_3, -\sigma_3, -i\sigma_2;$
$\Lambda;$	$\Gamma\Lambda/\Gamma X;$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$G;$	$XG;$	$C_{2z}, \sigma_y, I, \mathcal{T};$	$R_5;$	$2;$	$-i\sigma_2, i\sigma_1, -i\sigma_2;$
$P;$	$TW;$	$C_{2z}, \bar{E}, I, \mathcal{T};$	$\{R_5, R_5\};$	$2;$	$-i\sigma_0, -\sigma_0, -i\sigma_2;$
			$\{R_7, R_7\};$	$2;$	$i\sigma_0, -\sigma_0, -i\sigma_2;$
$\Sigma;$	$\Gamma\Sigma/\Gamma X;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$F;$	$XF;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2;$	$-i\sigma_2, -i\sigma_1, -i\sigma_2;$
$D;$	$SW;$	$C_{2x}, \bar{E}, I, \mathcal{T};$	$\{R_5, R_7\};$	$2;$	$i\sigma_3, -\sigma_0, -i\sigma_2;$
$\Delta;$	$\Gamma\Delta/\Gamma X;$	$C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$U;$	$XU;$	$C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5;$	$2;$	$i\sigma_2, -i\sigma_1, -i\sigma_2;$
$Q;$	$RW;$	$C_{2y}, \bar{E}, I, \mathcal{T};$	$\{R_5, R_7\};$	$2;$	$-i\sigma_3, -\sigma_0, -i\sigma_2;$

SG 75

 $\Gamma_q; \{C_{4z}^+|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$M;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$Z;$	$(00\frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$A;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$R;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{2z}; \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$X;$	$(0\frac{1}{2}0);$	$C_{2z}; \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$\Delta;$	$\Gamma X;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$U;$	$ZR;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$\Lambda;$	$\Gamma Z;$	$C_{4z}^+;$	$R_2;$	$1; \sqrt[4]{-1};$	
			$R_4;$	$1; (-1)^{3/4};$	
			$R_6;$	$1; -\sqrt[4]{-1};$	
			$R_8;$	$1; -(-1)^{3/4};$	
$V;$	$MA;$	$C_{4z}^+;$	$R_2;$	$1; \sqrt[4]{-1};$	
			$R_4;$	$1; (-1)^{3/4};$	
			$R_6;$	$1; -\sqrt[4]{-1};$	
			$R_8;$	$1; -(-1)^{3/4};$	
$\Sigma;$	$\Gamma M;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$S;$	$ZA;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$Y;$	$XM;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$T;$	$RA;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$W;$	$XR;$	$C_{2z};$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	



$\Gamma_q; \{C_{4z}^+ | 00\frac{1}{4}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP;	1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP;	1
$M;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP;	1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP;	1
$Z;$	$(00\frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
			$\{R_3, R_7\};$	$2; i\sigma_3, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
			$\{R_5, R_5\};$	$2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
$A;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
			$\{R_3, R_7\};$	$2; i\sigma_3, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
			$\{R_5, R_5\};$	$2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
$R;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{2z}; \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
			$\{R_3, R_3\};$	$2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
$X;$	$(0\frac{1}{2}0);$	$C_{2z}; \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP;	1
$\Delta;$	$\Gamma X;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$		
$U;$	$ZR;$	$\bar{E}, \mathcal{T}C_{2z};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;	
$\Lambda;$	$\Gamma Z;$	$C_{4z}^+;$	$R_2;$	$1; \sqrt[4]{-1};$		
			$R_4;$	$1; (-1)^{3/4};$		
			$R_6;$	$1; -\sqrt[4]{-1};$		
			$R_8;$	$1; -(-1)^{3/4};$		
$V;$	$MA;$	$C_{4z}^+;$	$R_2;$	$1; \sqrt[4]{-1};$		
			$R_4;$	$1; (-1)^{3/4};$		
			$R_6;$	$1; -\sqrt[4]{-1};$		
			$R_8;$	$1; -(-1)^{3/4};$		
$\Sigma;$	$\Gamma M;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$		
$S;$	$ZA;$	$\bar{E}, \mathcal{T}C_{2z};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;	
$Y;$	$XM;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$		
$T;$	$RA;$	$\bar{E}, \mathcal{T}C_{2z};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;	
$W;$	$XR;$	$C_{2z};$	$R_2;$	$1; i;$		
			$R_4;$	$1; -i;$		

SG 77

 $\Gamma_q; \{C_{4z}^+ | 00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$M;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$Z;$	$(00\frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$A;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$R;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{2z}; \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$X;$	$(0\frac{1}{2}0);$	$C_{2z}; \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$\Delta;$	$\Gamma X;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
			$R_4;$	$1; (-1)^{3/4};$	
			$R_6;$	$1; -\sqrt[4]{-1};$	
			$R_8;$	$1; -(-1)^{3/4};$	
$U;$	$ZR;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
			$R_4;$	$1; (-1)^{3/4};$	
			$R_6;$	$1; -\sqrt[4]{-1};$	
			$R_8;$	$1; -(-1)^{3/4};$	
$\Lambda;$	$\Gamma Z;$	$C_{4z}^+;$	$R_2;$	$1; \sqrt[4]{-1};$	
			$R_4;$	$1; (-1)^{3/4};$	
			$R_6;$	$1; -\sqrt[4]{-1};$	
			$R_8;$	$1; -(-1)^{3/4};$	
$V;$	$MA;$	$C_{4z}^+;$	$R_2;$	$1; \sqrt[4]{-1};$	
			$R_4;$	$1; (-1)^{3/4};$	
			$R_6;$	$1; -\sqrt[4]{-1};$	
			$R_8;$	$1; -(-1)^{3/4};$	
$\Sigma;$	$\Gamma M;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$S;$	$ZA;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$Y;$	$XM;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$T;$	$RA;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$W;$	$XR;$	$C_{2z};$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	

SG 78

 $\Gamma_q; \{C_{4z}^+ | 00 \frac{3}{4}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP;	1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP;	1
$M;$	$(\frac{1}{2} \frac{1}{2} 0);$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP;	1
			$\{R_4, R_6\};$	$2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP;	1
$Z;$	$(00 \frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
			$\{R_3, R_7\};$	$2; i\sigma_3, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
			$\{R_5, R_5\};$	$2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
$A;$	$(\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
			$\{R_3, R_7\};$	$2; i\sigma_3, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
			$\{R_5, R_5\};$	$2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
$R;$	$(0 \frac{1}{2} \frac{1}{2});$	$C_{2z}; \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
			$\{R_3, R_3\};$	$2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;	
$X;$	$(0 \frac{1}{2} 0);$	$C_{2z}; \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP;	1
$\Delta;$	$\Gamma X;$	$\bar{E}, \mathcal{T} C_{2z};$	$R_2;$	$1; -1, 1;$		
$U;$	$ZR;$	$\bar{E}, \mathcal{T} C_{2z};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;	
$\Lambda;$	$\Gamma Z;$	$C_{4z}^+;$	$R_2;$	$1; \sqrt[4]{-1};$		
			$R_4;$	$1; (-1)^{3/4};$		
			$R_6;$	$1; -\sqrt[4]{-1};$		
			$R_8;$	$1; -(-1)^{3/4};$		
$V;$	$MA;$	$C_{4z}^+;$	$R_2;$	$1; \sqrt[4]{-1};$		
			$R_4;$	$1; (-1)^{3/4};$		
			$R_6;$	$1; -\sqrt[4]{-1};$		
			$R_8;$	$1; -(-1)^{3/4};$		
$\Sigma;$	$\Gamma M;$	$\bar{E}, \mathcal{T} C_{2z};$	$R_2;$	$1; -1, 1;$		
$S;$	$ZA;$	$\bar{E}, \mathcal{T} C_{2z};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;	
$Y;$	$XM;$	$\bar{E}, \mathcal{T} C_{2z};$	$R_2;$	$1; -1, 1;$		
$T;$	$RA;$	$\bar{E}, \mathcal{T} C_{2z};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;	
$W;$	$XR;$	$C_{2z};$	$R_2;$	$1; i;$		
			$R_4;$	$1; -i;$		

SG 79

 $\Gamma_q^v; \{C_{4z}^+|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\}; 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
		$\{R_4, R_6\}; 2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$N; (0\frac{1}{2}0);$	$\bar{E}; \mathcal{T};$	$\{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$	C-1 WP; 1
$X; (00\frac{1}{2});$	$C_{2z}; \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+; \mathcal{T};$	$\{R_2, R_8\}; 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
		$\{R_4, R_6\}; 2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, C_{4z}^+; \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, \frac{e^{\frac{i\pi}{4}}(\sigma_1 - \sigma_2)}{\sqrt{2}};$	C-1 WP; 1
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+;$	$R_2; 1; \sqrt[4]{-1};$	
		$R_4; 1; (-1)^{3/4};$	
		$R_6; 1; -\sqrt[4]{-1};$	
		$R_8; 1; -(-1)^{3/4};$	
$V; ZV;$	$C_{4z}^+;$	$R_2; 1; \sqrt[4]{-1};$	
		$R_4; 1; (-1)^{3/4};$	
		$R_6; 1; -\sqrt[4]{-1};$	
		$R_8; 1; -(-1)^{3/4};$	
$W; XP;$	$C_{2z};$	$R_2; 1; i;$	
		$R_4; 1; -i;$	
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	
$F; ZF;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	
$Q; NP;$	$\bar{E};$	$R_2; 1; -1;$	
$\Delta; \Gamma X;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	
$U; ZU;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	
$Y; XZ/XY;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	

SG 80

 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{4z}^+, \mathcal{T};$	$\{R_2, R_8\}; 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
		$\{R_4, R_6\}; 2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$N; (0\frac{1}{2}0);$	$\bar{E}, \mathcal{T};$	$\{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$	C-1 WP; 1
$X; (00\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \mathcal{T};$	$\{R_2, R_8\}; 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
		$\{R_4, R_6\}; 2; \frac{\sigma_0 - i\sigma_3}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, C_{4z}^+, \mathcal{T};$	$R_2; 1; i, 1;$	
		$\{R_4, R_4\}; 2; -i\sigma_0, -i\sigma_2;$	C-2 WP; 2
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+;$	$R_2; 1; \sqrt[4]{-1};$	
		$R_4; 1; (-1)^{3/4};$	
		$R_6; 1; -\sqrt[4]{-1};$	
		$R_8; 1; -(-1)^{3/4};$	
$V; ZV;$	$C_{4z}^+, \bar{E};$	$R_2; 1; \sqrt[4]{-1}, -1;$	
		$R_4; 1; (-1)^{3/4}, -1;$	
		$R_6; 1; -\sqrt[4]{-1}, -1;$	
		$R_8; 1; -(-1)^{3/4}, -1;$	
$W; XP;$	$C_{2z};$	$R_2; 1; i;$	
		$R_4; 1; -i;$	
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	
$F; ZF;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	
$Q; NP;$	$\bar{E};$	$R_2; 1; -1;$	
$\Delta; \Gamma X;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	
$U; ZU;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	
$Y; XZ/XY;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	

SG 81

 $\Gamma_q; \{S_{4z}^+|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000); $S_{4z}^+, \mathcal{T}$ ;	$\{R_2, R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
	$\{R_4, R_6\}$ ; 2; $\frac{\sigma_0-i\sigma_3}{-\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
$M$ ; $(\frac{1}{2}\frac{1}{2}0)$ ; $S_{4z}^+, \mathcal{T}$ ;	$\{R_2, R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{MA}$ ;	
	$\{R_4, R_6\}$ ; 2; $\frac{\sigma_0-i\sigma_3}{-\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{MA}$ ;	
$Z$ ; $(00\frac{1}{2})$ ; $S_{4z}^+, \mathcal{T}$ ;	$\{R_2, R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
	$\{R_4, R_6\}$ ; 2; $\frac{\sigma_0-i\sigma_3}{-\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
$A$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $S_{4z}^+, \mathcal{T}$ ;	$\{R_2, R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{MA}$ ;	
	$\{R_4, R_6\}$ ; 2; $\frac{\sigma_0-i\sigma_3}{-\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{MA}$ ;	
$R$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_{2z}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$X$ ; $(0\frac{1}{2}0)$ ; $C_{2z}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$\Delta$ ; $\Gamma X$ ; $\bar{E}, \mathcal{T}C_{2z}$ ;	$R_2$ ; 1; -1, 1;		
$U$ ; $ZR$ ; $\bar{E}, \mathcal{T}C_{2z}$ ;	$R_2$ ; 1; -1, 1;		
$\Lambda$ ; $\Gamma Z$ ; $C_{2z}, S_{4z}^+, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, \frac{e^{-i\pi/4}(\sigma_1+\sigma_2)}{\sqrt{2}}$ ;	WNL;	$\pi$
$V$ ; $MA$ ; $C_{2z}, S_{4z}^+, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, \frac{e^{-i\pi/4}(\sigma_1+\sigma_2)}{\sqrt{2}}$ ;	WNL;	$\pi$
$\Sigma$ ; $\Gamma M$ ; $\bar{E}, \mathcal{T}C_{2z}$ ;	$R_2$ ; 1; -1, 1;		
$S$ ; $ZA$ ; $\bar{E}, \mathcal{T}C_{2z}$ ;	$R_2$ ; 1; -1, 1;		
$Y$ ; $XM$ ; $\bar{E}, \mathcal{T}C_{2z}$ ;	$R_2$ ; 1; -1, 1;		
$T$ ; $RA$ ; $\bar{E}, \mathcal{T}C_{2z}$ ;	$R_2$ ; 1; -1, 1;		
$W$ ; $XR$ ; $C_{2z}$ ;	$R_2$ ; 1; $i$ ;		
	$R_4$ ; 1; $-i$ ;		

SG 82

 $\Gamma_q^v; \{S_{4z}^+|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000);	$S_{4z}^+, \mathcal{T}$ ;	$\{R_2, R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
		$\{R_4, R_6\}$ ; 2; $\frac{\sigma_0-i\sigma_3}{-\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
$N$ ; $(0\frac{1}{2}0)$ ;	$\bar{E}, \mathcal{T}$ ;	$\{R_2, R_2\}$ ; 2; $-\sigma_0, -i\sigma_2$ ;	C-1 WP;	1
$X$ ; $(00\frac{1}{2})$ ;	$C_{2z}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$Z$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;	$S_{4z}^+, \mathcal{T}$ ;	$\{R_2, R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
		$\{R_4, R_6\}$ ; 2; $\frac{\sigma_0-i\sigma_3}{-\sqrt{2}}, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
$P$ ; $(\frac{1}{4}\frac{1}{4}\frac{1}{4})$ ;	$S_{4z}^+$ ;	$R_2$ ; 1; $\sqrt[4]{-1}$ ;		
		$R_4$ ; 1; $(-1)^{3/4}$ ;		
		$R_6$ ; 1; $-\sqrt[4]{-1}$ ;		
		$R_8$ ; 1; $-(-1)^{3/4}$ ;		
$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{2z}, S_{4z}^+, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, \frac{e^{-i\pi/4}(\sigma_1+\sigma_2)}{\sqrt{2}}$ ;	WNL;	$\pi$
$V$ ; ZV;	$C_{2z}, S_{4z}^+, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, \frac{e^{-i\pi/4}(\sigma_1+\sigma_2)}{\sqrt{2}}$ ;	WNL;	$\pi$
$W$ ; XP;	$C_{2z}$ ;	$R_2$ ; 1; $i$ ;		
		$R_4$ ; 1; $-i$ ;		
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$\bar{E}, \mathcal{T}C_{2z}$ ;	$R_2$ ; 1; $-1, 1$ ;		
$F$ ; ZF;	$\bar{E}, \mathcal{T}C_{2z}$ ;	$R_2$ ; 1; $-1, 1$ ;		
$Q$ ; NP;	$\bar{E}$ ;	$R_2$ ; 1; $-1$ ;		
$\Delta$ ; $\Gamma X$ ;	$\bar{E}, \mathcal{T}C_{2z}$ ;	$R_2$ ; 1; $-1, 1$ ;		
$U$ ; ZU;	$\bar{E}, \mathcal{T}C_{2z}$ ;	$R_2$ ; 1; $-1, 1$ ;		
$Y$ ; XZ/XY;	$\bar{E}, \mathcal{T}C_{2z}$ ;	$R_2$ ; 1; $-1, 1$ ;		

$\Gamma_q; \{C_{4z}^+|000\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; (000); C_{4z}^+, I, \mathcal{T}; \{R_2, R_8\}; & 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2; \\
& \{R_4, R_6\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2; \\
& \{R_{10}, R_{16}\}; 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2; \\
& \{R_{12}, R_{14}\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2; \\
M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, I, \mathcal{T}; \{R_2, R_8\}; & 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2; \\
& \{R_4, R_6\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2; \\
& \{R_{10}, R_{16}\}; 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2; \\
& \{R_{12}, R_{14}\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2; \\
Z; (00\frac{1}{2}); C_{4z}^+, I, \mathcal{T}; \{R_2, R_8\}; & 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2; \\
& \{R_4, R_6\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2; \\
& \{R_{10}, R_{16}\}; 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2; \\
& \{R_{12}, R_{14}\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2; \\
A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, I, \mathcal{T}; \{R_2, R_8\}; & 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2; \\
& \{R_4, R_6\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2; \\
& \{R_{10}, R_{16}\}; 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2; \\
& \{R_{12}, R_{14}\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2; \\
R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; & 2; i\sigma_3, \sigma_0, -i\sigma_2; \\
& \{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2; \\
X; (0\frac{1}{2}0); C_{2z}, I, \mathcal{T}; \{R_2, R_4\}; & 2; i\sigma_3, \sigma_0, -i\sigma_2; \\
& \{R_6, R_8\}; 2; i\sigma_3, -\sigma_0, -i\sigma_2; \\
\Delta; \Gamma X; \sigma_z, I\mathcal{T}; \{R_2, R_4\}; & 2; i\sigma_3, -i\sigma_2; \\
U; ZR; \sigma_z, I\mathcal{T}; \{R_2, R_4\}; & 2; i\sigma_3, -i\sigma_2; \\
\Lambda; \Gamma Z; C_{4z}^+, I\mathcal{T}; \{R_2, R_8\}; & 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2; \\
& \{R_4, R_6\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -i\sigma_2; \\
V; MA; C_{4z}^+, I\mathcal{T}; \{R_2, R_8\}; & 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2; \\
& \{R_4, R_6\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -i\sigma_2; \\
\Sigma; \Gamma M; \sigma_z, I\mathcal{T}; \{R_2, R_4\}; & 2; i\sigma_3, -i\sigma_2; \\
S; ZA; \sigma_z, I\mathcal{T}; \{R_2, R_4\}; & 2; i\sigma_3, -i\sigma_2; \\
Y; XM; \sigma_z, I\mathcal{T}; \{R_2, R_4\}; & 2; i\sigma_3, -i\sigma_2; \\
T; RA; \sigma_z, I\mathcal{T}; \{R_2, R_4\}; & 2; i\sigma_3, -i\sigma_2; \\
W; XR; C_{2z}, I\mathcal{T}; \{R_2, R_4\}; & 2; i\sigma_3, -i\sigma_2;
\end{aligned}$$



$\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, I, \mathcal{T};$	$\{R_2, R_8\};$	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$
	$\{R_4, R_6\};$	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$
	$\{R_{10}, R_{16}\};$	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$
	$\{R_{12}, R_{14}\};$	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, I, \mathcal{T};$	$\{R_2, R_8\};$	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$
	$\{R_4, R_6\};$	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$
	$\{R_{10}, R_{16}\};$	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$
	$\{R_{12}, R_{14}\};$	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$
$Z; (00\frac{1}{2}); C_{4z}^+, E, I, \mathcal{T};$	$\{R_{19}, R_{20}\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,1}}{\sqrt{2}}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, E, I, \mathcal{T};$	$\{R_{19}, R_{20}\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,1}}{\sqrt{2}}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, \sigma_0, -i\sigma_2;$
	$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_0, -i\sigma_2;$
$X; (0\frac{1}{2}0); C_{2z}, I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, \sigma_0, -i\sigma_2;$
	$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_0, -i\sigma_2;$
$\Delta; \Gamma X; \sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$
$U; ZR; \sigma_z, E, I\mathcal{T};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$
$\Lambda; \Gamma Z; C_{4z}^+, I\mathcal{T};$	$\{R_2, R_8\};$	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$
	$\{R_4, R_6\};$	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -i\sigma_2;$
$V; MA; C_{4z}^+, I\mathcal{T};$	$\{R_2, R_8\};$	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$
	$\{R_4, R_6\};$	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -i\sigma_2;$
$\Sigma; \Gamma M; \sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$
$S; ZA; \sigma_z, E, I\mathcal{T};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$
$Y; XM; \sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$
$T; RA; \sigma_z, E, I\mathcal{T};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$
$W; XR; C_{2z}, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{4z}^+, I, \mathcal{T};$	$\{R_2, R_8\};$	$2;$	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
			$\{R_4, R_6\};$	$2;$	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
			$\{R_{10}, R_{16}\};$	$2;$	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$	
			$\{R_{12}, R_{14}\};$	$2;$	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$	
$M;$	$(\frac{1}{2} \frac{1}{2} 0);$	$C_{4z}^+, E, I, \mathcal{T};$	$\{R_{19}, R_{20}\};$	$4;$	$\frac{\Gamma_{0,1} + i\Gamma_{3,1}}{\sqrt{2}}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$Z;$	$(00\frac{1}{2});$	$C_{4z}^+, I, \mathcal{T};$	$\{R_2, R_8\};$	$2;$	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
			$\{R_4, R_6\};$	$2;$	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
			$\{R_{10}, R_{16}\};$	$2;$	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$	
			$\{R_{12}, R_{14}\};$	$2;$	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$	
$A;$	$(\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$C_{4z}^+, E, I, \mathcal{T};$	$\{R_{19}, R_{20}\};$	$4;$	$\frac{\Gamma_{0,1} + i\Gamma_{3,1}}{\sqrt{2}}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$R;$	$(0\frac{1}{2} \frac{1}{2});$	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4;$	$\Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$X;$	$(0\frac{1}{2} 0);$	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4;$	$\Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$\Delta;$	$\Gamma X;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, -i\sigma_2;$	
$U;$	$ZR;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, -i\sigma_2;$	
$\Lambda;$	$\Gamma Z;$	$C_{4z}^+, I\mathcal{T};$	$\{R_2, R_8\};$	$2;$	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	
			$\{R_4, R_6\};$	$2;$	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	
$V;$	$MA;$	$C_{4z}^+, E, I\mathcal{T};$	$\{R_{10}, R_{12}\};$	$2;$	$\frac{-\sigma_3 - i\sigma_0}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
			$\{R_{14}, R_{16}\};$	$2;$	$\frac{\sigma_3 + i\sigma_0}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
$\Sigma;$	$\Gamma M;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, -i\sigma_2;$	
$S;$	$ZA;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, -i\sigma_2;$	
$Y;$	$XM;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	$2;$	$\sigma_3, -i\sigma_2;$	
$T;$	$RA;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	$2;$	$\sigma_3, -i\sigma_2;$	
$W;$	$XR;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_2\};$	$2;$	$i\sigma_0, -i\sigma_2;$	
			$\{R_4, R_4\};$	$2;$	$-i\sigma_0, -i\sigma_2;$	

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{4z}^+, I, \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
			$\{R_4, R_6\};$	$2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
			$\{R_{10}, R_{16}\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$	
			$\{R_{12}, R_{14}\};$	$2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$	
$M;$	$(\frac{1}{2} \frac{1}{2} 0);$	$C_{4z}^+, E, I, \mathcal{T};$	$\{R_{19}, R_{20}\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,1}}{\sqrt{2}}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$Z;$	$(00 \frac{1}{2});$	$C_{4z}^+, E, I, \mathcal{T};$	$\{R_{19}, R_{20}\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,1}}{\sqrt{2}}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$A;$	$(\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$C_{4z}^+, I, \mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
			$\{R_4, R_6\};$	$2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
			$\{R_{10}, R_{16}\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$	
			$\{R_{12}, R_{14}\};$	$2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$	
$R;$	$(0 \frac{1}{2} \frac{1}{2});$	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$X;$	$(0 \frac{1}{2} 0);$	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$\Delta;$	$\Gamma X;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	
$U;$	$ZR;$	$\sigma_z, E, I\mathcal{T};$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, -i\sigma_2;$	
$\Lambda;$	$\Gamma Z;$	$C_{4z}^+, I\mathcal{T};$	$\{R_2, R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	
			$\{R_4, R_6\};$	$2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	
$V;$	$MA;$	$C_{4z}^+, E, I\mathcal{T};$	$\{R_{10}, R_{12}\};$	$2; \frac{-\sigma_3 - i\sigma_0}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
			$\{R_{14}, R_{16}\};$	$2; \frac{\sigma_3 + i\sigma_0}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
$\Sigma;$	$\Gamma M;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	
$S;$	$ZA;$	$\sigma_z, E, I\mathcal{T};$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, -i\sigma_2;$	
$Y;$	$XM;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	
$T;$	$RA;$	$\sigma_z, E, I\mathcal{T};$	$\{R_5, R_7\};$	$2; -\sigma_3, \sigma_0, -i\sigma_2;$	
$W;$	$XR;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$	
			$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$	

SG 87

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; $(000)$ ;	$C_{4z}^+, I, \mathcal{T}$ ;	$\{R_2, R_8\}$ ;	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2$ ;
		$\{R_4, R_6\}$ ;	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2$ ;
		$\{R_{10}, R_{16}\}$ ;	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2$ ;
		$\{R_{12}, R_{14}\}$ ;	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2$ ;
$N$ ; $(0\frac{1}{2}0)$ ;	$I, \bar{E}, \mathcal{T}$ ;	$\{R_2, R_2\}$ ;	2;	$\sigma_0, -\sigma_0, -i\sigma_2$ ;
		$\{R_4, R_4\}$ ;	2;	$-\sigma_0, -\sigma_0, -i\sigma_2$ ;
$X$ ; $(00\frac{1}{2})$ ;	$C_{2z}, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, \sigma_0, -i\sigma_2$ ;
		$\{R_6, R_8\}$ ;	2;	$i\sigma_3, -\sigma_0, -i\sigma_2$ ;
$Z$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;	$C_{4z}^+, I, \mathcal{T}$ ;	$\{R_2, R_8\}$ ;	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2$ ;
		$\{R_6, R_6\}$ ;	2;	$-\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2$ ;
		$\{R_{10}, R_{16}\}$ ;	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2$ ;
		$\{R_{12}, R_{14}\}$ ;	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2$ ;
$P$ ; $(\frac{1}{4}\frac{1}{4}\frac{1}{4})$ ;	$S_{4z}^+, I\mathcal{T}$ ;	$\{R_2, R_8\}$ ;	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;
		$\{R_4, R_6\}$ ;	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;
$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, I\mathcal{T}$ ;	$\{R_2, R_8\}$ ;	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;
		$\{R_4, R_6\}$ ;	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;
$V$ ; $ZV$ ;	$C_{4z}^+, I\mathcal{T}$ ;	$\{R_2, R_8\}$ ;	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;
		$\{R_4, R_6\}$ ;	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -i\sigma_2$ ;
$W$ ; $XP$ ;	$C_{2z}, I\mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$\sigma_z, I\mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;
$F$ ; $ZF$ ;	$\sigma_z, I\mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;
$Q$ ; $NP$ ;	$\bar{E}, I\mathcal{T}$ ;	$\{R_2, R_2\}$ ;	2;	$-\sigma_0, -i\sigma_2$ ;
$\Delta$ ; $\Gamma X$ ;	$\sigma_z, I\mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;
$U$ ; $ZU$ ;	$\sigma_z, I\mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;
$Y$ ; $XZ/XY$ ;	$\sigma_z, I\mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;

$\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{I | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, I, \mathcal{T};$	$\{R_2, R_8\};$	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
		$\{R_4, R_6\};$	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
		$\{R_{10}, R_{16}\};$	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$	
		$\{R_{12}, R_{14}\};$	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -\sigma_0, -i\sigma_2;$	
$N; (0\frac{1}{2}0);$	$I, \bar{E}, \mathcal{T};$	$\{R_2, R_2\};$	2;	$\sigma_0, -\sigma_0, -i\sigma_2;$	
		$\{R_4, R_4\};$	2;	$-\sigma_0, -\sigma_0, -i\sigma_2;$	
$X; (00\frac{1}{2});$	$\sigma_z, E, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$\Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, E, I, \mathcal{T};$	$\{R_{19}, R_{20}\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,1}}{\sqrt{2}}, -\Gamma_{0,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, I\mathcal{T};$	$\{R_2, R_6\};$	2;	$\sqrt[4]{-1}\sigma_3, -i\sigma_2;$	
		$\{R_4, R_4\};$	2;	$(-1)^{3/4}\sigma_0, -i\sigma_2;$	
		$\{R_8, R_8\};$	2;	$-(-1)^{3/4}\sigma_0, -i\sigma_2;$	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, I\mathcal{T};$	$\{R_2, R_8\};$	2;	$\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	
		$\{R_4, R_6\};$	2;	$-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, -i\sigma_2;$	
$V; ZV;$	$C_{4z}^+, E, I\mathcal{T};$	$\{R_{10}, R_{12}\};$	2;	$\frac{\sigma_3 + i\sigma_0}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
		$\{R_{14}, R_{16}\};$	2;	$\frac{-\sigma_3 - i\sigma_0}{\sqrt{2}}, \sigma_0, -i\sigma_2;$	
$W; XP;$	$C_{2z}, I\mathcal{T};$	$\{R_2, R_2\};$	2;	$i\sigma_0, -i\sigma_2;$	
		$\{R_4, R_4\};$	2;	$-i\sigma_0, -i\sigma_2;$	
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	
$F; ZF;$	$\sigma_z, E, I\mathcal{T};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$	
$Q; NP;$	$\bar{E}, I\mathcal{T};$	$\{R_2, R_2\};$	2;	$-\sigma_0, -i\sigma_2;$	
$\Delta; \Gamma X;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	
$U; ZU;$	$\sigma_z, E, I\mathcal{T};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$	
$Y; XZ/XY;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$\sigma_3, -i\sigma_2;$	

SG 89

 $\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{4z}^+, C_{2x}, \mathcal{T}$ ; $R_6$ ; 2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
		$R_7$ ; 2; $\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$M$ ; $(\frac{1}{2}\frac{1}{2}0)$ ;	$C_{4z}^+, C_{2x}, \mathcal{T}$ ; $R_6$ ; 2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
		$R_7$ ; 2; $\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$Z$ ; $(00\frac{1}{2})$ ;	$C_{4z}^+, C_{2x}, \mathcal{T}$ ; $R_6$ ; 2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
		$R_7$ ; 2; $\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$A$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;	$C_{4z}^+, C_{2x}, \mathcal{T}$ ; $R_6$ ; 2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
		$R_7$ ; 2; $\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$R$ ; $(0\frac{1}{2}\frac{1}{2})$ ;	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ; 2;	$i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$X$ ; $(0\frac{1}{2}0)$ ;	$C_{2z}, C_{2y}, \mathcal{T}$ ; $R_5$ ; 2;	$i\sigma_2, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$\Delta$ ; $\Gamma X$ ;	$C_{2y}, \mathcal{T}C_{2z}$ ; $R_2$ ; 1;	$i, 1$ ;
		$R_4$ ; 1; $-i, 1$ ;
$U$ ; $ZR$ ;	$C_{2y}, \mathcal{T}C_{2z}$ ; $R_2$ ; 1;	$i, 1$ ;
		$R_4$ ; 1; $-i, 1$ ;
$\Lambda$ ; $\Gamma Z$ ;	$C_{4z}^+, C_{2b}, \mathcal{T}$ ; $R_2$ ; 1;	$\sqrt[4]{-1}, 1$ ;
		$R_4$ ; 1; $(-1)^{3/4}, 1$ ;
		$R_6$ ; 1; $-\sqrt[4]{-1}, 1$ ;
		$R_8$ ; 1; $-(-1)^{3/4}, 1$ ;
$V$ ; $MA$ ;	$C_{4z}^+, C_{2b}, \mathcal{T}$ ; $R_2$ ; 1;	$\sqrt[4]{-1}, 1$ ;
		$R_4$ ; 1; $(-1)^{3/4}, 1$ ;
		$R_6$ ; 1; $-\sqrt[4]{-1}, 1$ ;
		$R_8$ ; 1; $-(-1)^{3/4}, 1$ ;
$\Sigma$ ; $\Gamma M$ ;	$C_{2a}, C_{2b}, \mathcal{T}$ ; $R_2$ ; 1;	$i, 1$ ;
		$R_4$ ; 1; $-i, 1$ ;
$S$ ; $ZA$ ;	$C_{2a}, C_{2b}, \mathcal{T}$ ; $R_2$ ; 1;	$i, 1$ ;
		$R_4$ ; 1; $-i, 1$ ;
$Y$ ; $XM$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ; $R_2$ ; 1;	$i, 1$ ;
		$R_4$ ; 1; $-i, 1$ ;
$T$ ; $RA$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ; $R_2$ ; 1;	$i, 1$ ;
		$R_4$ ; 1; $-i, 1$ ;
$W$ ; $XR$ ;	$C_{2z}, \mathcal{T}C_{2y}$ ; $R_2$ ; 1;	$i, 1$ ;
		$R_4$ ; 1; $-i, 1$ ;

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 $\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 


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$\Gamma$ ; (000);	$C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_6$ ;	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
		$R_7$ ;	2;	$\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
$M$ ; ( $\frac{1}{2}\frac{1}{2}0$ );	$C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$\{R_6, R_7\}$ ;	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ;	C-2 DP;	2
$Z$ ; ( $00\frac{1}{2}$ );	$C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_6$ ;	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
		$R_7$ ;	2;	$\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
$A$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$\{R_6, R_7\}$ ;	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ;	C-2 DP;	2
$R$ ; ( $0\frac{1}{2}\frac{1}{2}$ );	$C_{2y}, C_{2x}, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2;	$-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>MARX</sub> ;	
		$\{R_7, R_8\}$ ;	2;	$\sigma_0, -i\sigma_3, -i\sigma_2$ ;	P-NS <sub>MARX</sub> ;	
$X$ ; ( $0\frac{1}{2}0$ );	$C_{2y}, C_{2x}, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2;	$-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>MARX</sub> ;	
		$\{R_7, R_8\}$ ;	2;	$\sigma_0, -i\sigma_3, -i\sigma_2$ ;	P-NS <sub>MARX</sub> ;	
$\Delta$ ; $\Gamma X$ ;	$C_{2y}, \mathcal{T}C_{2z}$ ;	$R_2$ ;	1;	$i, 1$ ;		
		$R_4$ ;	1;	$-i, 1$ ;		
$U$ ; $ZR$ ;	$C_{2y}, \mathcal{T}C_{2z}$ ;	$R_2$ ;	1;	$i, 1$ ;		
		$R_4$ ;	1;	$-i, 1$ ;		
$\Lambda$ ; $\Gamma Z$ ;	$C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1;	$(-1)^{1/4}, 1$ ;		
		$R_4$ ;	1;	$(-1)^{3/4}, 1$ ;		
		$R_6$ ;	1;	$-(-1)^{1/4}, 1$ ;		
		$R_8$ ;	1;	$-(-1)^{3/4}, 1$ ;		
$V$ ; $MA$ ;	$C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$\{R_2, R_6\}$ ;	2;	$(-1)^{1/4}\sigma_3, \sigma_1$ ;	L-NSs;	
		$\{R_4, R_8\}$ ;	2;	$(-1)^{3/4}\sigma_3, \sigma_1$ ;	L-NSs;	
$\Sigma$ ; $\Gamma M$ ;	$C_{2a}, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1;	$i, 1$ ;		
		$R_4$ ;	1;	$-i, 1$ ;		
$S$ ; $ZA$ ;	$C_{2a}, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1;	$i, 1$ ;		
		$R_4$ ;	1;	$-i, 1$ ;		
$Y$ ; $XM$ ;	$C_{2x}, E, \mathcal{T}C_{2y}$ ;	$\{R_5, R_7\}$ ;	2;	$-i\sigma_3, \sigma_0, -i\sigma_2$ ;	L-NS <sub>MARX</sub> ;	
$T$ ; $RA$ ;	$C_{2x}, E, \mathcal{T}C_{2y}$ ;	$\{R_5, R_7\}$ ;	2;	$-i\sigma_3, \sigma_0, -i\sigma_2$ ;	L-NS <sub>MARX</sub> ;	
$W$ ; $XR$ ;	$C_{2z}, \mathcal{T}C_{2y}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	L-NS <sub>MARX</sub> ;	

SG 91

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{4}\}, \{C_{2x}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000); $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
	$R_7$ ;	2; $\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$M$ ; $(\frac{1}{2}\frac{1}{2}0)$ ; $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
	$R_7$ ;	2; $\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$Z$ ; $(00\frac{1}{2})$ ; $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$\{R_8, R_{10}\}$ ;	2; $\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;
	$\{R_9, R_{11}\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;
	$R_{14}$ ;	2; $i\sigma_3, i\sigma_2, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;
$A$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$\{R_8, R_{10}\}$ ;	2; $\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;
	$\{R_9, R_{11}\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;
	$R_{14}$ ;	2; $i\sigma_3, i\sigma_2, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;
$R$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;
	$\{R_7, R_8\}$ ;	2; $\sigma_0, -i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;
$X$ ; $(0\frac{1}{2}0)$ ; $C_{2z}, C_{2y}, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	
$U$ ; $ZR$ ; $C_{2y}, E, \mathcal{T}C_{2z}$ ;	$\{R_5, R_7\}$ ;	2; $-i\sigma_3, \sigma_0, -i\sigma_2$ ;	L-NS <sub>ZAR</sub> ;
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1; $\sqrt[4]{-1}, 1$ ;	
	$R_4$ ;	1; $(-1)^{3/4}, 1$ ;	
	$R_6$ ;	1; $-\sqrt[4]{-1}, 1$ ;	
	$R_8$ ;	1; $-(-1)^{3/4}, 1$ ;	
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1; $\sqrt[4]{-1}, 1$ ;	
	$R_4$ ;	1; $(-1)^{3/4}, 1$ ;	
	$R_6$ ;	1; $-\sqrt[4]{-1}, 1$ ;	
	$R_8$ ;	1; $-(-1)^{3/4}, 1$ ;	
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	
$S$ ; $ZA$ ; $C_{2a}, \bar{E}, C_{2b}, \mathcal{T}$ ;	$\{R_{12}, R_{16}\}$ ;	2; $i\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>ZAR</sub> ;
$Y$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2y}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	
$T$ ; $RA$ ; $C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	L-NS <sub>ZAR</sub> ;
$W$ ; $XR$ ; $C_{2z}, \mathcal{T}C_{2y}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	



$\Gamma_q; \{C_{4z}^+|00\frac{1}{4}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; $(000)$ ; $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_6$ ;	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
	$R_7$ ;	2;	$\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
$M$ ; $(\frac{1}{2}\frac{1}{2}0)$ ; $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$\{R_6, R_7\}$ ;	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ;	C-2 DP;	2
$Z$ ; $(00\frac{1}{2})$ ; $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$\{R_8, R_{10}\}$ ;	2;	$\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;	
	$\{R_9, R_{11}\}$ ;	2;	$-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;	
	$R_{14}$ ;	2;	$i\sigma_3, i\sigma_2, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;	
$A$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$\{R_8, R_{11}\}$ ;	2;	$i\sigma_3, i\sigma_3, -i\sigma_2$ ;	P-NSs;	
	$\{R_9, R_{10}\}$ ;	2;	$i\sigma_3, -i\sigma_3, -i\sigma_2$ ;	P-NSs;	
	$\{R_{12}, R_{12}\}$ ;	4;	$-\Gamma_{0,2}, i\Gamma_{0,3}, -\Gamma_{2,1}$ ;	C-4 QDP;	4
$R$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_{2x}, C_{2y}, \mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1}$ ;	C-2 DP;	2
$X$ ; $(0\frac{1}{2}0)$ ; $C_{2y}, C_{2x}, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2;	$-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>MARX</sub> ;	
	$\{R_7, R_8\}$ ;	2;	$\sigma_0, -i\sigma_3, -i\sigma_2$ ;	P-NS <sub>MARX</sub> ;	
$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ;	$R_2$ ;	1;	$i, 1$ ;		
	$R_4$ ;	1;	$-i, 1$ ;		
$U$ ; $ZR$ ; $C_{2y}, E, \mathcal{T}C_{2z}$ ;	$\{R_5, R_7\}$ ;	2;	$-i\sigma_3, \sigma_0, -i\sigma_2$ ;	L-NS <sub>ZAR</sub> ;	
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1;	$\sqrt[4]{-1}, 1$ ;		
	$R_4$ ;	1;	$(-1)^{3/4}, 1$ ;		
	$R_6$ ;	1;	$-\sqrt[4]{-1}, 1$ ;		
	$R_8$ ;	1;	$-(-1)^{3/4}, 1$ ;		
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$\{R_2, R_6\}$ ;	2;	$\sqrt[4]{-1}\sigma_3, \sigma_1$ ;	L-NSs;	
	$\{R_4, R_8\}$ ;	2;	$(-1)^{3/4}\sigma_3, \sigma_1$ ;	L-NSs;	
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1;	$i, 1$ ;		
	$R_4$ ;	1;	$-i, 1$ ;		
$S$ ; $ZA$ ; $C_{2a}, \bar{E}, C_{2b}, \mathcal{T}$ ;	$\{R_{12}, R_{16}\}$ ;	2;	$i\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>ZAR</sub> ;	
$Y$ ; $XM$ ; $C_{2x}, E, \mathcal{T}C_{2y}$ ;	$\{R_5, R_7\}$ ;	2;	$-i\sigma_3, \sigma_0, -i\sigma_2$ ;	L-NS <sub>MARX</sub> ;	
$T$ ; $RA$ ; $C_{2x}, E, \mathcal{T}C_{2y}$ ;	$\{R_5, R_5\}$ ;	2;	$-i\sigma_0, \sigma_0, -i\sigma_2$ ;	L-NSs;	
	$\{R_7, R_7\}$ ;	2;	$i\sigma_0, \sigma_0, -i\sigma_2$ ;	L-NSs;	
$W$ ; $XR$ ; $C_{2z}, \mathcal{T}C_{2y}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	L-NS <sub>MARX</sub> ;	

SG 93

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{C_{2x}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$ (000); $C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_7; 2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$M;$ ( $\frac{1}{2}\frac{1}{2}0$ ); $C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_7; 2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$Z;$ ( $00\frac{1}{2}$ ); $C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_7; 2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$A;$ ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ ); $C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_7; 2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$R;$ ( $0\frac{1}{2}\frac{1}{2}$ ); $C_{2z}, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$X;$ ( $0\frac{1}{2}0$ ); $C_{2z}, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$\Delta;$ $\Gamma X;$ $C_{2y}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$U;$ $ZR;$ $C_{2y}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$\Lambda;$ $\Gamma Z;$ $C_{4z}^+, C_{2b}, \mathcal{T};$	$R_2; 1; \sqrt[4]{-1}, 1;$	
	$R_4; 1; (-1)^{3/4}, 1;$	
	$R_6; 1; -\sqrt[4]{-1}, 1;$	
	$R_8; 1; -(-1)^{3/4}, 1;$	
$V;$ $MA;$ $C_{4z}^+, C_{2b}, \mathcal{T};$	$R_2; 1; \sqrt[4]{-1}, 1;$	
	$R_4; 1; (-1)^{3/4}, 1;$	
	$R_6; 1; -\sqrt[4]{-1}, 1;$	
	$R_8; 1; -(-1)^{3/4}, 1;$	
$\Sigma;$ $\Gamma M;$ $C_{2a}, C_{2b}, \mathcal{T};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$S;$ $ZA;$ $C_{2a}, E, C_{2b}, \mathcal{T};$	$R_5; 1; -i, 1, 1;$	
	$R_7; 1; i, 1, 1;$	
$Y;$ $XM;$ $C_{2x}, \mathcal{T}C_{2y};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$T;$ $RA;$ $C_{2x}, \mathcal{T}C_{2y};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$W;$ $XR;$ $C_{2z}, \mathcal{T}C_{2y};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	

SG 94

 $\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP;	1
	$R_7;$	2;	$\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP;	1
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, C_{2x}, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	C-2 DP;	2
$Z; (00 \frac{1}{2}); C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP;	1
	$R_7;$	2;	$\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP;	1
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, C_{2x}, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	C-2 DP;	2
$R; (0 \frac{1}{2} \frac{1}{2}); C_{2y}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>MARX</sub> ;	
	$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>MARX</sub> ;	
$X; (0 \frac{1}{2} 0); C_{2y}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>MARX</sub> ;	
	$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>MARX</sub> ;	
$\Delta; \Gamma X; C_{2y}, \mathcal{T} C_{2z};$	$R_2;$	1;	$i, 1;$		
	$R_4;$	1;	$-i, 1;$		
$U; ZR; C_{2y}, \mathcal{T} C_{2z};$	$R_2;$	1;	$i, 1;$		
	$R_4;$	1;	$-i, 1;$		
$\Lambda; \Gamma Z; C_{4z}^+, C_{2b} \mathcal{T};$	$R_2;$	1;	$\sqrt[4]{-1}, 1;$		
	$R_4;$	1;	$(-1)^{3/4}, 1;$		
	$R_6;$	1;	$-\sqrt[4]{-1}, 1;$		
	$R_8;$	1;	$-(-1)^{3/4}, 1;$		
$V; MA; C_{4z}^+, C_{2b} \mathcal{T};$	$\{R_2, R_6\};$	2;	$\sqrt[4]{-1} \sigma_3, \sigma_1;$	L-NSs;	
	$\{R_4, R_8\};$	2;	$(-1)^{3/4} \sigma_3, \sigma_1;$	L-NSs;	
$\Sigma; \Gamma M; C_{2a}, C_{2b} \mathcal{T};$	$R_2;$	1;	$i, 1;$		
	$R_4;$	1;	$-i, 1;$		
$S; ZA; C_{2a}, E, C_{2b} \mathcal{T};$	$R_5;$	1;	$-i, 1, 1;$		
	$R_7;$	1;	$i, 1, 1;$		
$Y; XM; C_{2x}, E, \mathcal{T} C_{2y};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$	L-NS <sub>MARX</sub> ;	
$T; RA; C_{2x}, E, \mathcal{T} C_{2y};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$	L-NS <sub>MARX</sub> ;	
$W; XR; C_{2z}, \mathcal{T} C_{2y};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	L-NS <sub>MARX</sub> ;	

SG 95

 $\Gamma_q; \{C_{4z}^+|00\frac{3}{4}\}, \{C_{2x}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$Z; (00\frac{1}{2}); C_{4z}^+, C_{2x}, \mathcal{T};$	$\{R_8, R_{10}\};$	$2; \sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;
	$\{R_9, R_{11}\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;
	$R_{14};$	$2; i\sigma_3, i\sigma_2, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2x}, \mathcal{T};$	$\{R_8, R_{10}\};$	$2; \sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;
	$\{R_9, R_{11}\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;
	$R_{14};$	$2; i\sigma_3, i\sigma_2, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;
	$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>ZAR</sub> ;
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$U; ZR; C_{2y}, E, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, -i\sigma_2;$	L-NS <sub>ZAR</sub> ;
$\Lambda; \Gamma Z; C_{4z}^+, C_{2b}, \mathcal{T};$	$R_2;$	$1; \sqrt[4]{-1}, 1;$	
	$R_4;$	$1; (-1)^{3/4}, 1;$	
	$R_6;$	$1; -\sqrt[4]{-1}, 1;$	
	$R_8;$	$1; -(-1)^{3/4}, 1;$	
$V; MA; C_{4z}^+, C_{2b}, \mathcal{T};$	$R_2;$	$1; \sqrt[4]{-1}, 1;$	
	$R_4;$	$1; (-1)^{3/4}, 1;$	
	$R_6;$	$1; -\sqrt[4]{-1}, 1;$	
	$R_8;$	$1; -(-1)^{3/4}, 1;$	
$\Sigma; \Gamma M; C_{2a}, C_{2b}, \mathcal{T};$	$R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$S; ZA; C_{2a}, \bar{E}, C_{2b}, \mathcal{T};$	$\{R_{10}, R_{14}\};$	$2; -i\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>ZAR</sub> ;
$Y; XM; C_{2x}, \mathcal{T}C_{2y};$	$R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$T; RA; C_{2x}, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	L-NS <sub>ZAR</sub> ;
$W; XR; C_{2z}, \mathcal{T}C_{2y};$	$R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	

$\Gamma_q; \{C_{4z}^+ | 00 \frac{3}{4}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; $(000)$ ; $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_6$ ;	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
	$R_7$ ;	2;	$\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP;	1
$M$ ; $(\frac{1}{2} \frac{1}{2} 0)$ ; $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$\{R_6, R_7\}$ ;	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ;	C-2 DP;	2
$Z$ ; $(00 \frac{1}{2})$ ; $C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$\{R_8, R_{10}\}$ ;	2;	$\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;	
	$\{R_9, R_{11}\}$ ;	2;	$-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;	
	$R_{14}$ ;	2;	$i\sigma_3, i\sigma_2, -i\sigma_2$ ;	P-NS <sub>ZAR</sub> ;	
$A$ ; $(\frac{1}{2} \frac{1}{2} \frac{1}{2})$ ; $C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$\{R_8, R_{11}\}$ ;	2;	$i\sigma_3, i\sigma_3, -i\sigma_2$ ;	P-NSs;	
	$\{R_9, R_{10}\}$ ;	2;	$i\sigma_3, -i\sigma_3, -i\sigma_2$ ;	P-NSs;	
	$\{R_{12}, R_{12}\}$ ;	4;	$-\Gamma_{0,2}, i\Gamma_{0,3}, -\Gamma_{2,1}$ ;	C-4 QDP;	4
$R$ ; $(0 \frac{1}{2} \frac{1}{2})$ ; $C_{2x}, C_{2y}, \mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1}$ ;	C-2 DP;	2
$X$ ; $(0 \frac{1}{2} 0)$ ; $C_{2y}, C_{2x}, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2;	$-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>MARX</sub> ;	
	$\{R_7, R_8\}$ ;	2;	$\sigma_0, -i\sigma_3, -i\sigma_2$ ;	P-NS <sub>MARX</sub> ;	
$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T} C_{2z}$ ;	$R_2$ ;	1;	$i, 1$ ;		
	$R_4$ ;	1;	$-i, 1$ ;		
$U$ ; $ZR$ ; $C_{2y}, E, \mathcal{T} C_{2z}$ ;	$\{R_5, R_7\}$ ;	2;	$-i\sigma_3, \sigma_0, -i\sigma_2$ ;	L-NS <sub>ZAR</sub> ;	
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1;	$\sqrt[4]{-1}, 1$ ;		
	$R_4$ ;	1;	$(-1)^{3/4}, 1$ ;		
	$R_6$ ;	1;	$-\sqrt[4]{-1}, 1$ ;		
	$R_8$ ;	1;	$-(-1)^{3/4}, 1$ ;		
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$\{R_2, R_6\}$ ;	2;	$\sqrt[4]{-1}\sigma_3, \sigma_1$ ;	L-NSs;	
	$\{R_4, R_8\}$ ;	2;	$(-1)^{3/4}\sigma_3, \sigma_1$ ;	L-NSs;	
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1;	$i, 1$ ;		
	$R_4$ ;	1;	$-i, 1$ ;		
$S$ ; $ZA$ ; $C_{2a}, \bar{E}, C_{2b}, \mathcal{T}$ ;	$\{R_{12}, R_{16}\}$ ;	2;	$-i\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>ZAR</sub> ;	
$Y$ ; $XM$ ; $C_{2x}, E, \mathcal{T} C_{2y}$ ;	$\{R_5, R_7\}$ ;	2;	$-i\sigma_3, \sigma_0, -i\sigma_2$ ;	L-NS <sub>MARX</sub> ;	
$T$ ; $RA$ ; $C_{2x}, E, \mathcal{T} C_{2y}$ ;	$\{R_5, R_5\}$ ;	2;	$-i\sigma_0, \sigma_0, -i\sigma_2$ ;	L-NSs;	
	$\{R_7, R_7\}$ ;	2;	$i\sigma_0, \sigma_0, -i\sigma_2$ ;	L-NSs;	
$W$ ; $XR$ ; $C_{2z}, \mathcal{T} C_{2y}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;	L-NS <sub>MARX</sub> ;	

SG 97

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
		$R_7$ ;	2; $\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$N$ ; $(0\frac{1}{2}0)$ ;	$C_{2y}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ;	C-1 WP; 1
$X$ ; $(00\frac{1}{2})$ ;	$C_{2z}, C_{2b}, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$Z$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;	$C_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
		$R_7$ ;	2; $\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$P$ ; $(\frac{1}{4}\frac{1}{4}\frac{1}{4})$ ;	$C_{2z}, C_{2y}, C_{2b}, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -\frac{i(\sigma_1+\sigma_3)}{\sqrt{2}}$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1; $\sqrt[4]{-1}, 1$ ;	
		$R_4$ ;	1; $(-1)^{3/4}, 1$ ;	
		$R_6$ ;	1; $-\sqrt[4]{-1}, 1$ ;	
		$R_8$ ;	1; $-(-1)^{3/4}, 1$ ;	
$V$ ; $ZV$ ;	$C_{4z}^+, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1; $\sqrt[4]{-1}, 1$ ;	
		$R_4$ ;	1; $(-1)^{3/4}, 1$ ;	
		$R_6$ ;	1; $-\sqrt[4]{-1}, 1$ ;	
		$R_8$ ;	1; $-(-1)^{3/4}, 1$ ;	
$W$ ; $XP$ ;	$C_{2z}, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$F$ ; $ZF$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$Q$ ; $NP$ ;	$C_{2y}$ ;	$R_2$ ;	1; $i$ ;	
		$R_4$ ;	1; $-i$ ;	
$\Delta$ ; $\Gamma X$ ;	$C_{2a}, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$U$ ; $ZU$ ;	$C_{2a}, C_{2b}, \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	
$Y$ ; $XZ/XY$ ;	$C_{2b}, \mathcal{T}C_{2z}$ ;	$R_2$ ;	1; $i, 1$ ;	
		$R_4$ ;	1; $-i, 1$ ;	

SG 98

 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{C_{2x} | 0 \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	2; $\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, i\sigma_2;$	C-1 WP; 1
		$R_7;$	2; $\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, i\sigma_2;$	C-1 WP; 1
$N; (0 \frac{1}{2} 0);$	$C_{2y}, \mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, i\sigma_2;$	C-1 WP; 1
$X; (00 \frac{1}{2});$	$C_{2z}, C_{2b}, \mathcal{T};$	$R_5;$	2; $i\sigma_2, i\sigma_1, i\sigma_2;$	C-1 WP; 1
$Z; (\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	2; $\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, i\sigma_2;$	C-1 WP; 1
		$R_7;$	2; $\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, i\sigma_2;$	C-1 WP; 1
$P; (\frac{1}{4} \frac{1}{4} \frac{1}{4});$	$C_{2x}, C_{2y}, C_{2b}, \mathcal{T};$	$\{R_1, R_4\};$	2; $\sigma_3, \sigma_3, \sigma_1;$	C-2 WP; 2
		$R_2;$	1; 1, -1, 1;	
		$R_3;$	1; -1, 1, 1;	
		$R_4;$	1; $\sqrt[4]{-1}, 1;$	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, C_{2b}, \mathcal{T};$	$R_2;$	1; $\sqrt[4]{-1}, 1;$	
		$R_4;$	1; $(-1)^{3/4}, 1;$	
		$R_6;$	1; $-\sqrt[4]{-1}, 1;$	
		$R_8;$	1; $-(-1)^{3/4}, 1;$	
$V; ZV;$	$C_{4z}^+, E, C_{2b}, \mathcal{T};$	$R_{10};$	1; $\sqrt[4]{-1}, 1, 1;$	
		$R_{12};$	1; $(-1)^{3/4}, 1, 1;$	
		$R_{14};$	1; $-\sqrt[4]{-1}, 1, 1;$	
		$R_{16};$	1; $-(-1)^{3/4}, 1, 1;$	
$W; XP;$	$C_{2z}, C_{2b}, \mathcal{T};$	$R_2;$	1; $i, 1;$	
		$R_4;$	1; $-i, 1;$	
$\Sigma; \Gamma Z/\Gamma \Sigma;$	$C_{2x}, \mathcal{T} C_{2y};$	$R_2;$	1; $i, 1;$	
		$R_4;$	1; $-i, 1;$	
$F; ZF;$	$C_{2x}, \mathcal{T} C_{2y};$	$R_2;$	1; $i, 1;$	
		$R_4;$	1; $-i, 1;$	
$Q; NP;$	$C_{2y}, E;$	$R_5;$	1; $-i, 1;$	
		$R_7;$	1; $i, 1;$	
$\Delta; \Gamma X;$	$C_{2a}, C_{2b}, \mathcal{T};$	$R_2;$	1; $i, 1;$	
		$R_4;$	1; $-i, 1;$	
$U; ZU;$	$C_{2a}, E, C_{2b}, \mathcal{T};$	$R_5;$	1; $-i, 1, 1;$	
		$R_7;$	1; $i, 1, 1;$	
$Y; XZ/XY;$	$C_{2b}, \mathcal{T} C_{2z};$	$R_2;$	1; $i, 1;$	
		$R_4;$	1; $-i, 1;$	

SG 99

 $\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6; 2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
			$R_7; 2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6; 2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
			$R_7; 2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$Z;$	$(00\frac{1}{2});$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6; 2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
			$R_7; 2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$A;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6; 2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
			$R_7; 2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$R;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XR};$	
$X;$	$(0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XR};$	
$\Delta;$	$\Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$		
			$R_4; 1; -i, 1;$		
$U;$	$ZR;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$		
			$R_4; 1; -i, 1;$		
$\Lambda;$	$\Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_6; 2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
			$R_7; 2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$V;$	$MA;$	$C_{4z}^+, \sigma_y;$	$R_6; 2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
			$R_7; 2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$\Sigma;$	$\Gamma M;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2; 1; i, 1;$		
			$R_4; 1; -i, 1;$		
$S;$	$ZA;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2; 1; i, 1;$		
			$R_4; 1; -i, 1;$		
$Y;$	$XM;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2; 1; i, 1;$		
			$R_4; 1; -i, 1;$		
$T;$	$RA;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2; 1; i, 1;$		
			$R_4; 1; -i, 1;$		
$W;$	$XR;$	$C_{2z}, \sigma_y;$	$R_5; 2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$



SG 100

 $\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{4z}^+,\sigma_y,\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
			$R_7;$	2;	$\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+,\sigma_x,\mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$Z;$	$(00\frac{1}{2});$	$C_{4z}^+,\sigma_y,\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
			$R_7;$	2;	$\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$A;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+,\sigma_x,\mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$R;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{RA};$	
			$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{RA};$	
$X;$	$(0\frac{1}{2}0);$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
			$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
$\Delta;$	$\Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	1;	$i, 1;$		
			$R_4;$	1;	$-i, 1;$		
$U;$	$ZR;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	1;	$i, 1;$		
			$R_4;$	1;	$-i, 1;$		
$\Lambda;$	$\Gamma Z;$	$C_{4z}^+,\sigma_y;$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
			$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$V;$	$MA;$	$C_{4z}^+,\sigma_x;$	$R_6;$	2;	$\frac{\sigma_1+i\sigma_0}{\sqrt{2}}, -\sigma_3;$	WNL;	$\pi$
			$R_7;$	2;	$\frac{\sigma_1-i\sigma_0}{\sqrt{2}}, -\sigma_3;$	WNL;	$\pi$
$\Sigma;$	$\Gamma M;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	1;	$i, 1;$		
			$R_4;$	1;	$-i, 1;$		
$S;$	$ZA;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	1;	$i, 1;$		
			$R_4;$	1;	$-i, 1;$		
$Y;$	$XM;$	$\sigma_y, E, \mathcal{T}\sigma_x;$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$	WNL;	$\pi$
$T;$	$RA;$	$\sigma_y, E, \mathcal{T}\sigma_x;$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$	WNL;	$\pi$
$W;$	$XR;$	$\sigma_y, C_{2z};$	$R_5;$	1;	$i, i;$		
			$R_6;$	1;	$i, -i;$		
			$R_7;$	1;	$-i, -i;$		
			$R_8;$	1;	$-i, i;$		

SG 101

 $\Gamma_q; \{C_{4z}^+ | 00\frac{1}{2}\}, \{\sigma_y | 00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
		$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
$Z; (00\frac{1}{2});$	$C_{4z}^+, \sigma_x, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_x, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$X; (0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XR};$	
$\Delta; \Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$U; ZR;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$\Lambda; \Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$V; MA;$	$C_{4z}^+, \sigma_y;$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma M;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$S; ZA;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$Y; XM;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$T; RA;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$W; XR;$	$C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$

$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{\sigma_y | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M; (\frac{1}{2} \frac{1}{2} 0);$	$C_{4z}^+, \sigma_x, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$Z; (00 \frac{1}{2});$	$C_{4z}^+, \sigma_x, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$C_{4z}^+, \sigma_x, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
$R; (0 \frac{1}{2} \frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{ZR};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{ZR};$	
$X; (0 \frac{1}{2} 0);$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
$\Delta; \Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$U; ZR;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$\Lambda; \Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$V; MA;$	$C_{4z}^+, \sigma_x;$	$R_6;$	$2; \frac{\sigma_1 + i\sigma_0}{\sqrt{2}}, -\sigma_3;$	WNL;	$\pi$
		$R_7;$	$2; \frac{\sigma_1 - i\sigma_0}{\sqrt{2}}, -\sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma M;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$S; ZA;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$Y; XM;$	$\sigma_y, E, \mathcal{T}\sigma_x;$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, -i\sigma_2;$	WNL;	$\pi$
$T; RA;$	$\sigma_y, E, \mathcal{T}\sigma_x;$	$R_5;$	$1; -1, 1, 1;$		
		$R_7;$	$1; 1, 1, 1;$		
$W; XR;$	$\sigma_y, C_{2z};$	$R_5;$	$1; i, i;$		
		$R_6;$	$1; i, -i;$		
		$R_7;$	$1; -i, -i;$		
		$R_8;$	$1; -i, i;$		

$\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	2;	$\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
		$R_7;$	2;	$\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
$Z; (00\frac{1}{2});$	$C_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_6, R_6\};$	4;	$\frac{\Gamma_{0,0}+i\Gamma_{0,2}}{\sqrt{2}}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP;	0
		$\{R_7, R_7\};$	4;	$\frac{\Gamma_{0,0}-i\Gamma_{0,2}}{-\sqrt{2}}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP;	0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_6, R_6\};$	4;	$\frac{\Gamma_{0,0}+i\Gamma_{0,2}}{\sqrt{2}}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP;	0
		$\{R_7, R_7\};$	4;	$\frac{\Gamma_{0,0}-i\Gamma_{0,2}}{-\sqrt{2}}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP;	0
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$X; (0\frac{1}{2}0);$	$C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XR};$	
$\Delta; \Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	1;	$i, 1;$		
		$R_4;$	1;	$-i, 1;$		
$U; ZR;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	2;	$\sigma_3, \sigma_1;$	WNL;	$\pi$
$\Lambda; \Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
		$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$V; MA;$	$C_{4z}^+, \sigma_y;$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
		$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma M;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	1;	$i, 1;$		
		$R_4;$	1;	$-i, 1;$		
$S; ZA;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_2, R_4\};$	2;	$\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XM;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	1;	$i, 1;$		
		$R_4;$	1;	$-i, 1;$		
$T; RA;$	$\sigma_y, \mathcal{T}\sigma_x;$	$\{R_2, R_4\};$	2;	$\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$W; XR;$	$C_{2z}, \sigma_y;$	$R_5;$	2;	$i\sigma_2, i\sigma_1;$	WNL;	$\pi$

$\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+, \sigma_x, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$Z; (00\frac{1}{2});$	$C_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_6, R_6\};$	$4; \frac{\Gamma_{0,0}+i\Gamma_{0,2}}{\sqrt{2}}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP;	0
		$\{R_7, R_7\};$	$4; \frac{\Gamma_{0,0}-i\Gamma_{0,2}}{\sqrt{2}}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP;	0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$R; (0\frac{1}{2}\frac{1}{2});$	$\sigma_y, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{ZR};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{ZR};$	
$X; (0\frac{1}{2}0);$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
$\Delta; \Gamma X;$	$\sigma_x, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$U; ZR;$	$\sigma_x, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$\Lambda; \Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
		$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$V; MA;$	$C_{4z}^+, \sigma_x;$	$R_6;$	$2; \frac{\sigma_1+i\sigma_0}{\sqrt{2}}, -\sigma_3;$	WNL;	$\pi$
		$R_7;$	$2; \frac{\sigma_1-i\sigma_0}{\sqrt{2}}, -\sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma M;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$S; ZA;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XM;$	$\sigma_y, E, \mathcal{T}\sigma_x;$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, -i\sigma_2;$	WNL;	$\pi$
$T; RA;$	$\sigma_y, E, \mathcal{T}\sigma_x;$	$R_5;$	$1; -1, 1, 1;$		
		$R_7;$	$1; 1, 1, 1;$		
$W; XR;$	$\sigma_y, C_{2z};$	$R_5;$	$1; i, i;$		
		$R_6;$	$1; i, -i;$		
		$R_7;$	$1; -i, -i;$		
		$R_8;$	$1; -i, i;$		

SG 105

 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+ \sigma_y \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
	$R_7;$	2;	$\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+ \sigma_y \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
	$R_7;$	2;	$\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
$Z; (00\frac{1}{2}); C_{4z}^+ \sigma_{db} \mathcal{T}; \{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;		0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+ \sigma_{db} \mathcal{T}; \{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;		0
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z} \sigma_y \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XR};$	
$X; (0\frac{1}{2}0); C_{2z} \sigma_y \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XR};$	
$\Delta; \Gamma X; \sigma_x \mathcal{T} C_{2z};$	$R_2;$	1;	$i, 1;$		
	$R_4;$	1;	$-i, 1;$		
$U; ZR; \sigma_x \mathcal{T} C_{2z};$	$R_2;$	1;	$i, 1;$		
	$R_4;$	1;	$-i, 1;$		
$\Lambda; \Gamma Z; C_{4z}^+ \sigma_y;$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
	$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$V; MA; C_{4z}^+ \sigma_y;$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
	$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma M; \sigma_{db} \mathcal{T} \sigma_{da};$	$R_2;$	1;	$i, 1;$		
	$R_4;$	1;	$-i, 1;$		
$S; ZA; \sigma_{db} \mathcal{T} \sigma_{da}; \{R_2, R_4\};$	2;	$\sigma_3, -i\sigma_2;$	WNL;		$\pi$
$Y; XM; \sigma_y \mathcal{T} \sigma_x;$	$R_2;$	1;	$i, 1;$		
	$R_4;$	1;	$-i, 1;$		
$T; RA; \sigma_y \mathcal{T} \sigma_x;$	$R_2;$	1;	$i, 1;$		
	$R_4;$	1;	$-i, 1;$		
$W; XR; C_{2z} \sigma_y;$	$R_5;$	2;	$i\sigma_2, i\sigma_1;$	WNL;	$\pi$

$\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+ \sigma_y \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	2;	$\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+ \sigma_x \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$Z; (00\frac{1}{2});$	$C_{4z}^+ \sigma_{db} \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+ \sigma_{db} \mathcal{T};$	$\{R_6, R_6\};$	4;	$\frac{\Gamma_{0,0}+i\Gamma_{0,2}}{\sqrt{2}}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP;	0
		$\{R_7, R_7\};$	4;	$\frac{\Gamma_{0,0}-i\Gamma_{0,2}}{-\sqrt{2}}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP;	0
$R; (0\frac{1}{2}\frac{1}{2});$	$\sigma_x C_{2z} \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{RA};$	
		$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{RA};$	
$X; (0\frac{1}{2}0);$	$\sigma_x C_{2z} \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
		$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
$\Delta; \Gamma X;$	$\sigma_x \mathcal{T} C_{2z};$	$R_2;$	1;	$i, 1;$		
		$R_4;$	1;	$-i, 1;$		
$U; ZR;$	$\sigma_x \mathcal{T} C_{2z};$	$R_2;$	1;	$i, 1;$		
		$R_4;$	1;	$-i, 1;$		
$\Lambda; \Gamma Z;$	$C_{4z}^+ \sigma_y;$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
		$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$V; MA;$	$C_{4z}^+ \sigma_x;$	$R_6;$	2;	$\frac{\sigma_1+i\sigma_0}{\sqrt{2}}, -\sigma_3;$	WNL;	$\pi$
		$R_7;$	2;	$\frac{\sigma_1-i\sigma_0}{\sqrt{2}}, -\sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma M;$	$\sigma_{db} \mathcal{T} \sigma_{da};$	$R_2;$	1;	$i, 1;$		
		$R_4;$	1;	$-i, 1;$		
$S; ZA;$	$\sigma_{db} \mathcal{T} \sigma_{da};$	$\{R_2, R_4\};$	2;	$\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XM;$	$\sigma_y E \mathcal{T} \sigma_x;$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$	WNL;	$\pi$
$T; RA;$	$\sigma_y E \mathcal{T} \sigma_x;$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$	WNL;	$\pi$
$W; XR;$	$\sigma_y C_{2z};$	$R_5;$	1;	$i, i;$		
		$R_6;$	1;	$i, -i;$		
		$R_7;$	1;	$-i, -i;$		
		$R_8;$	1;	$-i, i;$		

SG 107

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	P-WNL;	
$X; (00\frac{1}{2});$	$C_{2z}, \sigma_{db}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XP};$	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$C_{2z}, \sigma_{db}, C_{4z}^+, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -\frac{\sigma_0+i\sigma_2}{\sqrt{2}};$	P-WNL $_{XP};$	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
		$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$V; ZV;$	$C_{4z}^+, \sigma_y;$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
		$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$W; XP;$	$C_{2z}, \sigma_{db};$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$F; ZF;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$Q; NP;$	$\bar{E}, \mathcal{T}\sigma_y;$	$R_2;$	$1; -1, 1;$		
$\Delta; \Gamma X;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$U; ZU;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$Y; XZ/XY;$	$\sigma_{da}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		



SG 108

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{4z}^+, \sigma_y, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
		$R_7$ ;	2; $\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
$N$ ; (0 $\frac{1}{2}$ 0);	$\sigma_y, \bar{E}, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2; $\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL $_{NP}$ ;	
		$\{R_7, R_7\}$ ;	2; $-\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNL $_{NP}$ ;	
$X$ ; (00 $\frac{1}{2}$ );	$C_{2z}, \sigma_{db}, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{XP}$ ;	
$Z$ ; ( $\frac{1}{2}\frac{1}{2}\frac{1}{2}$ );	$C_{4z}^+, \sigma_y, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
		$R_7$ ;	2; $\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
$P$ ; ( $\frac{1}{4}\frac{1}{4}\frac{1}{4}$ );	$C_{2z}, \sigma_{db}, C_{4z}^+, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	4; $i\Gamma_{0,2}, i\Gamma_{0,1}, \frac{\Gamma_{2,2}+i\Gamma_{2,0}}{\sqrt{2}}$ ;	DP;	0
$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, \sigma_y$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1$ ;	WNL;	$\pi$
		$R_7$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1$ ;	WNL;	$\pi$
$V$ ; ZV;	$C_{4z}^+, \sigma_y$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1$ ;	WNL;	$\pi$
		$R_7$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1$ ;	WNL;	$\pi$
$W$ ; XP;	$C_{2z}, \sigma_{db}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1$ ;	WNL;	$\pi$
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$R_2$ ;	1; $i, 1$ ;		
		$R_4$ ;	1; $-i, 1$ ;		
$F$ ; ZF;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$R_2$ ;	1; $-i, 1$ ;		
		$R_4$ ;	1; $i, 1$ ;		
$Q$ ; NP;	$\bar{E}, \mathcal{T}\sigma_y$ ;	$\{R_2, R_2\}$ ;	2; $-\sigma_0, -i\sigma_2$ ;	WNL;	$\pi$
$\Delta$ ; $\Gamma X$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$R_2$ ;	1; $i, 1$ ;		
		$R_4$ ;	1; $-i, 1$ ;		
$U$ ; ZU;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$R_2$ ;	1; $-i, 1$ ;		
		$R_4$ ;	1; $i, 1$ ;		
$Y$ ; XZ/XY;	$\sigma_{da}, \mathcal{T}C_{2z}$ ;	$R_2$ ;	1; $i, 1$ ;		
		$R_4$ ;	1; $-i, 1$ ;		

$\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{\sigma_y | 000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	P-WNL;	
$X; (00\frac{1}{2});$	$\sigma_{db}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XZ};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XZ};$	
$Z; (\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$C_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$P; (\frac{1}{4} \frac{1}{4} \frac{1}{4});$	$\sigma_{db}, C_{2z}, C_{4z}^+ \mathcal{T};$	$R_{13};$	$1; -(-1)^{3/4}, i, 1;$		
		$R_{14};$	$1; (-1)^{3/4}, i, 1;$		
		$\{R_{17}, R_{18}\};$	$2; (-1)^{7/4} \sigma_3, -i\sigma_0, -i\sigma_2;$	P-WNLs;	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$V; ZV;$	$C_{4z}^+, \sigma_{db};$	$R_6;$	$2; \frac{\sigma_1 + i\sigma_0}{\sqrt{2}}, \sigma_3;$	WNL;	$\pi$
		$R_7;$	$2; \frac{\sigma_1 - i\sigma_0}{\sqrt{2}}, \sigma_3;$	WNL;	$\pi$
$W; XP;$	$\sigma_{da}, C_{2z};$	$R_5;$	$1; i, i;$		
		$R_6;$	$1; i, -i;$		
		$R_7;$	$1; -i, -i;$		
		$R_8;$	$1; -i, i;$		
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$F; ZF;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$Q; NP;$	$\bar{E}, \mathcal{T}\sigma_y;$	$R_2;$	$1; -1, 1;$		
$\Delta; \Gamma X;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$U; ZU;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XZ/XY;$	$\sigma_{da}, E, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, \sigma_1;$	WNL;	$\pi$

SG 110

 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{\sigma_y | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$C_{4z}^+, \sigma_y, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, \bar{E}, \mathcal{T};$	$\{R_5, R_5\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{NP};$	
		$\{R_7, R_7\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{NP};$	
$X; (00\frac{1}{2});$	$\sigma_{db}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XZ};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XZ};$	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$\sigma_{db}, C_{2z}, C_{4z}^+ \mathcal{T};$	$\{R_{13}, R_{14}\};$	$2; -(-1)^{3/4} \sigma_3, i\sigma_0, \sigma_1;$	P-WNLs;	
		$\{R_{17}, R_{17}\};$	$2; -(-1)^{3/4} \sigma_0, -i\sigma_0, -i\sigma_2;$	P-WNLs;	
		$\{R_{18}, R_{18}\};$	$2; (-1)^{3/4} \sigma_0, -i\sigma_0, -i\sigma_2;$	P-WNLs;	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y;$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1;$	WNL;	$\pi$
$V; ZV;$	$C_{4z}^+, \sigma_{db};$	$R_6;$	$2; \frac{\sigma_1 + i\sigma_0}{\sqrt{2}}, -\sigma_3;$	WNL;	$\pi$
		$R_7;$	$2; \frac{\sigma_1 - i\sigma_0}{\sqrt{2}}, -\sigma_3;$	WNL;	$\pi$
$W; XP;$	$\sigma_{da}, C_{2z};$	$R_5;$	$1; i, i;$		
		$R_6;$	$1; i, -i;$		
		$R_7;$	$1; -i, -i;$		
		$R_8;$	$1; -i, i;$		
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$F; ZF;$	$\sigma_y, \mathcal{T}\sigma_x;$	$R_2;$	$1; -i, 1;$		
		$R_4;$	$1; i, 1;$		
$Q; NP;$	$\bar{E}, \mathcal{T}\sigma_y;$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$\Delta; \Gamma X;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$U; ZU;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XZ/XY;$	$\sigma_{da}, E, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, \sigma_1;$	WNL;	$\pi$

## SG 111

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 


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$\Gamma; (000); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2; \text{P-WNL}_{\Gamma Z};$	
	$R_7; 2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2; \text{P-WNL}_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2; \text{P-WNL}_{MA};$	
	$R_7; 2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2; \text{P-WNL}_{MA};$	
$Z; (00\frac{1}{2}); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2; \text{P-WNL}_{\Gamma Z};$	
	$R_7; 2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2; \text{P-WNL}_{\Gamma Z};$	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2; \text{P-WNL}_{MA};$	
	$R_7; 2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2; \text{P-WNL}_{MA};$	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2; \text{C-1 WP};$	1
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2; \text{C-1 WP};$	1
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$U; \text{ZR}; C_{2y}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$\Lambda; \Gamma Z; C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}; \text{WNL};$	$\pi$
$V; \text{MA}; C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}; \text{WNL};$	$\pi$
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$S; \text{ZA}; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$Y; \text{XM}; C_{2x}, \mathcal{T}C_{2y};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$T; \text{RA}; C_{2x}, \mathcal{T}C_{2y};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$W; \text{XR}; C_{2z}, \mathcal{T}C_{2y};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 


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$\Gamma; (000); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
	$R_7;$	$2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
	$R_7;$	$2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
$Z; (00\frac{1}{2}); S_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP;	1
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP;	1
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$U; ZR; C_{2y}, E, \mathcal{T}C_{2z};$	$R_5;$	$1; -i, 1, 1;$		
	$R_7;$	$1; i, 1, 1;$		
$\Lambda; \Gamma Z; C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \frac{\sigma_0-i\sigma_2}{-\sqrt{2}};$	WNL;	$\pi$
$V; MA; C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \frac{\sigma_0-i\sigma_2}{-\sqrt{2}};$	WNL;	$\pi$
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$S; ZA; \sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XM; C_{2x}, \mathcal{T}C_{2y};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$T; RA; C_{2x}, E, \mathcal{T}C_{2y};$	$R_5;$	$1; -i, 1, 1;$		
	$R_7;$	$1; i, 1, 1;$		
$W; XR; C_{2z}, \mathcal{T}C_{2y};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 


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$\Gamma; (000); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
	$R_7;$	$2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2x}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL $_{MA};$	
$Z; (00\frac{1}{2}); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
	$R_7;$	$2; \frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, C_{2x}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL $_{MA};$	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2y}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS $_{MARX};$	
	$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS $_{MARX};$	
$X; (0\frac{1}{2}0); C_{2y}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS $_{MARX};$	
	$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS $_{MARX};$	
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$U; ZR; C_{2y}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$\Lambda; \Gamma Z; C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \frac{\sigma_0-i\sigma_2}{-\sqrt{2}};$	WNL;	$\pi$
$V; MA; C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T};$	$\{R_5, R_5\};$	$4; i\Gamma_{0,2}, -i\Gamma_{0,1}, \frac{i(\Gamma_{2,0}+i\Gamma_{2,2})}{\sqrt{2}};$	DNL;	$0$
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$S; ZA; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$Y; XM; C_{2x}, E, \mathcal{T}C_{2y};$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, -i\sigma_2;$	L-NS $_{MARX};$	
$T; RA; C_{2x}, E, \mathcal{T}C_{2y};$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, -i\sigma_2;$	L-NS $_{MARX};$	
$W; XR; C_{2z}, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	L-NS $_{MARX};$	

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 


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$\Gamma; (000); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
	$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2x}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL $_{MA};$	
$Z; (00\frac{1}{2}); S_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_6, R_6\};$	$4; \frac{\Gamma_{0,0} + i\Gamma_{0,2}}{\sqrt{2}}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL $_{MA};$	
	$\{R_7, R_7\};$	$4; -\frac{\Gamma_{0,0} - i\Gamma_{0,2}}{\sqrt{2}}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNL $_{MA};$	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2y}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS $_{MARX};$	
	$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS $_{MARX};$	
$X; (0\frac{1}{2}0); C_{2y}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS $_{MARX};$	
	$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS $_{MARX};$	
$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$U; ZR; C_{2y}, E, \mathcal{T}C_{2z};$	$R_5;$	$1; -i, 1, 1;$		
	$R_7;$	$1; i, 1, 1;$		
$\Lambda; \Gamma Z; C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}};$	WNL;	$\pi$
$V; MA; C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$\{R_5, R_5\};$	$4; i\Gamma_{0,2}, -i\Gamma_{0,1}, \frac{i(\Gamma_{2,0} + i\Gamma_{2,2})}{\sqrt{2}};$	DNL;	0
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$S; ZA; \sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XM; C_{2x}, E, \mathcal{T}C_{2y};$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, -i\sigma_2;$	L-NS $_{MARX};$	
$T; RA; C_{2x}, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	$2; -i\sigma_3, -i\sigma_2;$	L-NS $_{MARX};$	
$W; XR; C_{2z}, \mathcal{T}C_{2y};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	L-NS $_{MARX};$	

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
	$R_7; 2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
	$R_7; 2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
$Z; (00\frac{1}{2}); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
	$R_7; 2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
	$R_7; 2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, \sigma_y, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XR};$	
$X; (0\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{XR};$	
$\Delta; \Gamma X; \sigma_x, \mathcal{T}\sigma_y;$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$U; ZR; \sigma_x, \mathcal{T}\sigma_y;$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}};$	WNL;	$\pi$
$V; MA; C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}};$	WNL;	$\pi$
$\Sigma; \Gamma M; C_{2a}, C_{2b} \mathcal{T};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$S; ZA; C_{2a}, C_{2b} \mathcal{T};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$Y; XM; \sigma_y, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$T; RA; \sigma_y, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$W; XR; C_{2z}, \sigma_y;$	$R_5; 2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$



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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{\Gamma Z};$	
	$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{MA};$	
	$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{MA};$	
$Z; (00\frac{1}{2}); S_{4z}^+, \sigma_x, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	$\text{DP};$	0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, \sigma_x, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	$\text{DP};$	0
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, \sigma_x, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	$\text{DP};$	0
$X; (0\frac{1}{2}0); C_{2z}, \sigma_y, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	$\text{P-WNL}_{XR};$	
$\Delta; \Gamma X; \sigma_x, \mathcal{T}\sigma_y;$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$U; \text{ZR}; \sigma_x, \mathcal{T}\sigma_y;$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	$\text{WNL};$	$\pi$
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, S_{4z}^+, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}};$	$\text{WNL};$	$\pi$
$V; \text{MA}; C_{2z}, \sigma_y, S_{4z}^+, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}};$	$\text{WNL};$	$\pi$
$\Sigma; \Gamma M; C_{2a}, C_{2b}, \mathcal{T};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$S; \text{ZA}; C_{2a}, E, C_{2b}, \mathcal{T};$	$R_5;$	$1; -i, 1, 1;$		
	$R_7;$	$1; i, 1, 1;$		
$Y; \text{XM}; \sigma_y, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$T; \text{RA}; \sigma_y, \mathcal{T}C_{2z};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	$\text{WNL};$	$\pi$
$W; \text{XR}; C_{2z}, \sigma_y;$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	$\text{WNL};$	$\pi$

$\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
			$R_7;$	2;	$\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M;$	$(\frac{1}{2}\frac{1}{2}0);$	$S_{4z}^+, \sigma_x, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$Z;$	$(00\frac{1}{2});$	$S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
			$R_7;$	2;	$\frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$A;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_{4z}^+, \sigma_x, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$R;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{RA};$	
			$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{RA};$	
$X;$	$(0\frac{1}{2}0);$	$\sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
			$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
$\Delta;$	$\Gamma X;$	$\sigma_x, \mathcal{T}\sigma_y;$	$R_2;$	1;	$i, 1;$		
			$R_4;$	1;	$-i, 1;$		
$U;$	$ZR;$	$\sigma_x, \mathcal{T}\sigma_y;$	$R_2;$	1;	$i, 1;$		
			$R_4;$	1;	$-i, 1;$		
$\Lambda;$	$\Gamma Z;$	$C_{2z}, \sigma_y, S_{4z}^+, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}};$	WNL;	$\pi$
$V;$	$MA;$	$C_{2z}, \sigma_x, S_{4z}^+, \mathcal{T};$	$R_9;$	2;	$i\sigma_3, -\sigma_1, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}};$	WNL;	$\pi$
$\Sigma;$	$\Gamma M;$	$C_{2a}, C_{2b}, \mathcal{T};$	$R_2;$	1;	$i, 1;$		
			$R_4;$	1;	$-i, 1;$		
$S;$	$ZA;$	$C_{2a}, C_{2b}, \mathcal{T};$	$R_2;$	1;	$i, 1;$		
			$R_4;$	1;	$-i, 1;$		
$Y;$	$XM;$	$\sigma_y, E, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, \sigma_1;$	WNL;	$\pi$
$T;$	$RA;$	$\sigma_y, E, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, \sigma_1;$	WNL;	$\pi$
$W;$	$XR;$	$\sigma_y, C_{2z};$	$R_5;$	1;	$i, i;$		
			$R_6;$	1;	$i, -i;$		
			$R_7;$	1;	$-i, -i;$		
			$R_8;$	1;	$-i, i;$		

$\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
	$R_7;$	2;	$\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, \sigma_x, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$Z; (00\frac{1}{2}); S_{4z}^+, \sigma_x, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
	$R_7;$	2;	$\frac{\sigma_0-i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MA};$	
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_y, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{ZR};$	
	$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{ZR};$	
$X; (0\frac{1}{2}0); \sigma_x, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
	$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XM};$	
$\Delta; \Gamma X; \sigma_x, \mathcal{T}\sigma_y;$	$R_2;$	1;	$i, 1;$		
	$R_4;$	1;	$-i, 1;$		
$U; ZR; \sigma_x, \mathcal{T}\sigma_y;$	$\{R_2, R_4\};$	2;	$\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Lambda; \Gamma Z; C_{2z}, \sigma_y, S_{4z}^+, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -\frac{\sigma_0-i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$
$V; MA; C_{2z}, \sigma_x, S_{4z}^+, \mathcal{T};$	$R_9;$	2;	$i\sigma_3, -\sigma_1, \frac{i(\sigma_1+\sigma_2)}{\sqrt{2}};$	WNL;	$\pi$
$\Sigma; \Gamma M; C_{2a}, C_{2b}, \mathcal{T};$	$R_2;$	1;	$i, 1;$		
	$R_4;$	1;	$-i, 1;$		
$S; ZA; C_{2a}, E, C_{2b}, \mathcal{T};$	$R_5;$	1;	$-i, 1, 1;$		
	$R_7;$	1;	$i, 1, 1;$		
$Y; XM; \sigma_y, E, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, \sigma_1;$	WNL;	$\pi$
$T; RA; \sigma_y, E, \mathcal{T}C_{2z};$	$R_5;$	1;	$-1, 1, 1;$		
	$R_7;$	1;	$1, 1, 1;$		
$W; XR; \sigma_y, C_{2z};$	$R_5;$	1;	$i, i;$		
	$R_6;$	1;	$i, -i;$		
	$R_7;$	1;	$-i, -i;$		
	$R_8;$	1;	$-i, i;$		

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 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2a}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000);$	$S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	P-WNL;	
$X; (00\frac{1}{2});$	$C_{2z}, C_{2b}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP;	1
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, \mathcal{T}\sigma_y;$	$R_2;$	$1; \sqrt[4]{-1}, 1;$		
		$R_4;$	$1; (-1)^{3/4}, 1;$		
		$R_6;$	$1; -\sqrt[4]{-1}, 1;$		
		$R_8;$	$1; -(-1)^{3/4}, 1;$		
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$
$V; ZV;$	$C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$
$W; XP;$	$C_{2z}, C_{2b} \mathcal{T};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Sigma; \Gamma Z/\Gamma \Sigma;$	$\sigma_y, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$F; ZF;$	$\sigma_y, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$Q; NP;$	$\bar{E}, \mathcal{T}\sigma_y;$	$R_2;$	$1; -1, 1;$		
$\Delta; \Gamma X;$	$C_{2a}, C_{2b} \mathcal{T};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$U; ZU;$	$C_{2a}, C_{2b} \mathcal{T};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$Y; XZ/XY;$	$C_{2b}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		

SG 120

 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$\sigma_y, \bar{E}, \mathcal{T};$	$\{R_5, R_5\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{NP};$	
		$\{R_7, R_7\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$	P-WNL $_{NP};$	
$X; (00\frac{1}{2});$	$C_{2z}, C_{2b}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP;	1
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_{4z}^+, C_{2a}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, \mathcal{T}\sigma_y;$	$\{R_2, R_6\};$	$2; \sqrt[4]{-1}\sigma_3, -i\sigma_2;$	P-WNLs;	
		$\{R_4, R_8\};$	$2; (-1)^{3/4}\sigma_3, -i\sigma_2;$	P-WNLs;	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$
$V; ZV;$	$C_{2z}, \sigma_y, S_{4z}^+ \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$
$W; XP;$	$C_{2z}, C_{2b} \mathcal{T};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$\sigma_y, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$F; ZF;$	$\sigma_y, \mathcal{T}C_{2z};$	$R_2;$	$1; -i, 1;$		
		$R_4;$	$1; i, 1;$		
$Q; NP;$	$\bar{E}, \mathcal{T}\sigma_y;$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$\Delta; \Gamma X;$	$C_{2a}, C_{2b} \mathcal{T};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$U; ZU;$	$C_{2a}, C_{2b} \mathcal{T};$	$R_2;$	$1; -i, 1;$		
		$R_4;$	$1; i, 1;$		
$Y; XZ/XY;$	$C_{2b}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		

SG 121

 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000);	$S_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_6$ ;	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
		$R_7$ ;	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
$N$ ; $(0\frac{1}{2}0)$ ;	$C_{2y}, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	$2; i\sigma_3, -i\sigma_2$ ;	C-1 WP;	1
$X$ ; $(00\frac{1}{2})$ ;	$C_{2z}, \sigma_{db}, \mathcal{T}$ ;	$R_5$ ;	$2; i\sigma_2, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{XP}$ ;	
$Z$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;	$S_{4z}^+, C_{2x}, \mathcal{T}$ ;	$R_6$ ;	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
		$R_7$ ;	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	P-WNL $_{\Gamma Z}$ ;	
$P$ ; $(\frac{1}{4}\frac{1}{4}\frac{1}{4})$ ;	$S_{4z}^+, C_{2x}$ ;	$R_6$ ;	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1$ ;	P-WNL $_{XP}$ ;	
		$R_7$ ;	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1$ ;	P-WNL $_{XP}$ ;	
$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T}$ ;	$R_5$ ;	$2; i\sigma_2, i\sigma_1, \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}$ ;	WNL;	$\pi$
$V$ ; ZV;	$C_{2z}, \sigma_{db}, S_{4z}^+, \mathcal{T}$ ;	$R_5$ ;	$2; i\sigma_2, i\sigma_1, \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}$ ;	WNL;	$\pi$
$W$ ; XP;	$C_{2z}, \sigma_{db}$ ;	$R_5$ ;	$2; i\sigma_2, i\sigma_1$ ;	WNL;	$\pi$
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$R_2$ ;	$1; i, 1$ ;		
		$R_4$ ;	$1; -i, 1$ ;		
$F$ ; ZF;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$R_2$ ;	$1; i, 1$ ;		
		$R_4$ ;	$1; -i, 1$ ;		
$Q$ ; NP;	$C_{2y}$ ;	$R_2$ ;	$1; i$ ;		
		$R_4$ ;	$1; -i$ ;		
$\Delta$ ; $\Gamma X$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$R_2$ ;	$1; i, 1$ ;		
		$R_4$ ;	$1; -i, 1$ ;		
$U$ ; ZU;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$R_2$ ;	$1; i, 1$ ;		
		$R_4$ ;	$1; -i, 1$ ;		
$Y$ ; XZ/XY;	$\sigma_{da}, \mathcal{T}C_{2z}$ ;	$R_2$ ;	$1; i, 1$ ;		
		$R_4$ ;	$1; -i, 1$ ;		

SG 122

 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2x}|\frac{1}{4}\frac{3}{4}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
		$R_7;$	$2; \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma Z};$	
$N; (0\frac{1}{2}0);$	$C_{2y}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP;	1
$X; (00\frac{1}{2});$	$\sigma_{db}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{XZ};$	
		$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{XZ};$	
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_{4z}^+, \sigma_{db}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, \sigma_{da};$	$R_{13};$	$1; \sqrt[4]{-1}, \sqrt[4]{-1};$		
		$R_{14};$	$1; \sqrt[4]{-1}, -\sqrt[4]{-1};$		
		$R_{15};$	$1; -\sqrt[4]{-1}, \sqrt[4]{-1};$		
		$R_{16};$	$1; -\sqrt[4]{-1}, -\sqrt[4]{-1};$		
		$R_{20};$	$2; (-1)^{3/4}\sigma_2, \sqrt[4]{-1}\sigma_3;$	P-WNLs;	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}};$	WNL;	$\pi$
$V; ZV;$	$C_{2z}, \sigma_{db}, S_{4z}^+ \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \frac{\sigma_0 - i\sigma_2}{-\sqrt{2}};$	WNL;	$\pi$
$W; XP;$	$\sigma_{da}, C_{2z};$	$R_5;$	$1; i, i;$		
		$R_6;$	$1; i, -i;$		
		$R_7;$	$1; -i, -i;$		
		$R_8;$	$1; -i, i;$		
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$C_{2x}, \mathcal{T}C_{2y};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$F; ZF;$	$C_{2x}, E, \mathcal{T}C_{2y};$	$R_5;$	$1; -i, 1, 1;$		
		$R_7;$	$1; i, 1, 1;$		
$Q; NP;$	$C_{2y}, \bar{E};$	$R_{10};$	$1; -i, -1;$		
		$R_{14};$	$1; i, -1;$		
$\Delta; \Gamma X;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$U; ZU;$	$\sigma_{db}, \mathcal{T}\sigma_{da};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$Y; XZ/XY;$	$\sigma_{da}, E, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, \sigma_1;$	WNL;	$\pi$

$\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
&\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T}; R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2; \\
&\quad R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2; \\
&\quad R_{13}; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2; \\
&\quad R_{14}; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2; \\
&M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, I, \mathcal{T}; R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2; \\
&\quad R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2; \\
&\quad R_{13}; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2; \\
&\quad R_{14}; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2; \\
&Z; (00\frac{1}{2}); C_{4z}^+, C_{2x}, I, \mathcal{T}; R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2; \\
&\quad R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2; \\
&\quad R_{13}; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2; \\
&\quad R_{14}; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2; \\
&A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2x}, I, \mathcal{T}; R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2; \\
&\quad R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2; \\
&\quad R_{13}; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2; \\
&\quad R_{14}; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2; \\
&R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T}; R_5; 2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2; \\
&\quad R_{10}; 2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2; \\
&X; (0\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T}; R_5; 2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2; \\
&\quad R_{10}; 2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2; \\
&\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T}; R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2; \\
&U; ZR; C_{2y}, \sigma_x, I\mathcal{T}; R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2; \\
&\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T}; R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2; \\
&\quad R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2; \\
&V; MA; C_{4z}^+, \sigma_y, I\mathcal{T}; R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2; \\
&\quad R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2; \\
&\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T}; R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2; \\
&S; ZA; C_{2a}, \sigma_z, I\mathcal{T}; R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2; \\
&Y; XM; C_{2x}, \sigma_z, I\mathcal{T}; R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2; \\
&T; RA; C_{2x}, \sigma_z, I\mathcal{T}; R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2; \\
&W; XR; C_{2z}, \sigma_y, I\mathcal{T}; R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;
\end{aligned}$$



$\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{13};$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
	$R_{14};$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{13};$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
	$R_{14};$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Z; (00\frac{1}{2}); I, \sigma_{db}, C_{4z}^+, \mathcal{T};$	$\{R_{19}, R_{20}\};$	$4; \Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0}+i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$ DP; 0
	$\{R_{21}, R_{22}\};$	$4; \Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0}+i\Gamma_{0,2}}{-\sqrt{2}}, -i\Gamma_{2,0};$ DP; 0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); I, \sigma_{db}, C_{4z}^+, \mathcal{T};$	$\{R_{19}, R_{20}\};$	$4; \Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0}+i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$ DP; 0
	$\{R_{21}, R_{22}\};$	$4; \Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0}+i\Gamma_{0,2}}{-\sqrt{2}}, -i\Gamma_{2,0};$ DP; 0
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$U; ZR; \sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$V; MA; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$S; ZA; \sigma_z, C_{2a}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$Y; XM; C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$T; RA; \sigma_z, C_{2x}, I\mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$W; XR; C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
	$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_{19};$	4;	$-\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$Z; (00 \frac{1}{2}); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
	$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_{19};$	4;	$-\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$R; (0 \frac{1}{2} \frac{1}{2}); \sigma_x, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$X; (0 \frac{1}{2} 0); \sigma_x, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$U; ZR; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$V; MA; C_{4z}^+, \sigma_x, I\mathcal{T};$	$R_6;$	2;	$\frac{-\sigma_1 - i\sigma_0}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$
	$R_7;$	2;	$\frac{i(\sigma_0 + i\sigma_1)}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$S; ZA; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$Y; XM; \sigma_y, C_{2x}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$
$T; RA; \sigma_y, C_{2x}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$
$W; XR; \sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
	$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_{19};$	4;	$\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{-\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$Z; (00 \frac{1}{2}); I, \sigma_{db}, C_{4z}^+, \mathcal{T};$	$\{R_{19}, R_{20}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0} + i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$ DP; 0
	$\{R_{21}, R_{22}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0} + i\Gamma_{0,2}}{-\sqrt{2}}, -i\Gamma_{2,0};$ DP; 0
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_{19};$	4;	$\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{-\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$R; (0 \frac{1}{2} \frac{1}{2}); \sigma_y, \sigma_x, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$X; (0 \frac{1}{2} 0); \sigma_x, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$U; \text{ZR}; \sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$V; \text{MA}; C_{4z}^+, \sigma_x, I\mathcal{T};$	$R_6;$	2;	$\frac{-\sigma_1 - i\sigma_0}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$
	$R_7;$	2;	$\frac{i(\sigma_0 + i\sigma_1)}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$S; \text{ZA}; \sigma_z, C_{2a}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$
$Y; \text{XM}; \sigma_y, C_{2x}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$
$T; \text{RA}; C_{2x}, \sigma_z, I\mathcal{T};$	$R_9;$	2;	$i\sigma_3, -\sigma_1, -i\sigma_2;$
$W; \text{XR}; \sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
			$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
			$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
			$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$M;$	$(\frac{1}{2} \frac{1}{2} 0);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, \Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;	
			$\{R_{20}, R_{21}\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;	
$Z;$	$(00 \frac{1}{2});$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
			$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
			$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
			$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$A;$	$(\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, \Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;	
			$\{R_{20}, R_{21}\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;	
$R;$	$(0 \frac{1}{2} \frac{1}{2});$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>RA</sub> ;	
$X;$	$(0 \frac{1}{2} 0);$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XM</sub> ;	
$\Delta;$	$\Gamma X;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$U;$	$ZR;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$\Lambda;$	$\Gamma Z;$	$C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$		
			$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$		
$V;$	$MA;$	$C_{4z}^+, \sigma_x, I\mathcal{T};$	$\{R_6, R_7\};$	4;	$-\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, -\Gamma_{0,3}, -i\Gamma_{2,0};$	DNL;	0
$\Sigma;$	$\Gamma M;$	$C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$S;$	$ZA;$	$C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$Y;$	$XM;$	$\sigma_z, C_{2x}, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$T;$	$RA;$	$\sigma_z, C_{2x}, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$W;$	$XR;$	$\sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$		
			$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$		

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 00 \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
		$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$M; (\frac{1}{2} \frac{1}{2} 0);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, \Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;
		$\{R_{20}, R_{21}\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;
$Z; (00 \frac{1}{2});$	$I, \sigma_{db}, C_{4z}^+, \mathcal{T};$	$\{R_{19}, R_{20}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0} + i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$	DP; 0
		$\{R_{21}, R_{22}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, -\frac{\Gamma_{0,0} + i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$	DP; 0
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$I, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$\{R_{19}, R_{20}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0} + i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$	P-DNL <sub>MA</sub> ;
		$\{R_{21}, R_{22}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, -\frac{\Gamma_{0,0} + i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$	P-DNL <sub>MA</sub> ;
$R; (0 \frac{1}{2} \frac{1}{2});$	$C_{2y}, C_{2z}, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, \sigma_0, -i\sigma_2;$	
		$\{R_{15}, R_{16}\};$	2;	$-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$	
		$\{R_{17}, R_{18}\};$	2;	$\sigma_0, -i\sigma_3, -\sigma_0, -i\sigma_2;$	
$X; (0 \frac{1}{2} 0);$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XM</sub> ;
$\Delta; \Gamma X;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$U; \text{ZR};$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$	
		$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$\Lambda; \Gamma Z;$	$C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
		$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$V; \text{MA};$	$C_{4z}^+, \sigma_x, I\mathcal{T};$	$\{R_6, R_7\};$	4;	$-\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, -\Gamma_{0,3}, -i\Gamma_{2,0};$	DNL; 0
$\Sigma; \Gamma M;$	$C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$S; \text{ZA};$	$\sigma_z, C_{2a}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$	
		$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$Y; \text{XM};$	$\sigma_z, C_{2x}, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL; 0
$T; \text{RA};$	$C_{2x}, \sigma_y, E, I\mathcal{T};$	$\{R_6, R_8\};$	2;	$-i\sigma_3, -\sigma_0, \sigma_0, -i\sigma_2;$	
		$\{R_7, R_9\};$	2;	$-i\sigma_3, \sigma_0, \sigma_0, -i\sigma_2;$	
$W; \text{XR};$	$\sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$	

$\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000); $C_{4z}^+, C_{2x}, I, \mathcal{T}$ ; $R_6$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2$ ;		
	$R_7$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2$ ;		
	$R_{13}$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2$ ;		
	$R_{14}$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2$ ;		
$M$ ; $(\frac{1}{2}\frac{1}{2}0)$ ; $C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T}$ ; $R_{19}$ ;	$R_{19}$ ;	4; $-\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2}$ ;	P-DNL <sub>MA</sub> ;	
$Z$ ; $(00\frac{1}{2})$ ; $C_{4z}^+, C_{2x}, I, \mathcal{T}$ ; $R_6$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2$ ;		
	$R_7$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2$ ;		
	$R_{13}$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2$ ;		
	$R_{14}$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2$ ;		
$A$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T}$ ; $R_{19}$ ;	$R_{19}$ ;	4; $-\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2}$ ;	P-DNL <sub>MA</sub> ;	
$R$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_{2y}, C_{2x}, I, \mathcal{T}$ ; $\{R_{13}, R_{14}\}$ ;	$\{R_{13}, R_{14}\}$ ;	4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ;	P-DNL <sub>XR</sub> ;	
$X$ ; $(0\frac{1}{2}0)$ ; $C_{2y}, C_{2x}, I, \mathcal{T}$ ; $\{R_{13}, R_{14}\}$ ;	$\{R_{13}, R_{14}\}$ ;	4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ;	P-DNL <sub>XR</sub> ;	
$\Delta$ ; $\Gamma X$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ; $R_5$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;		
$U$ ; $ZR$ ; $C_{2y}, \sigma_x, I\mathcal{T}$ ; $R_5$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;		
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, I\mathcal{T}$ ; $R_6$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;		
	$R_7$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;		
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y, I\mathcal{T}$ ; $\{R_6, R_7\}$ ;	$\{R_6, R_7\}$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{3,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{2,0}$ ;	DNL;	0
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ; $R_5$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;		
$S$ ; $ZA$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ; $R_5$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;		
$Y$ ; $XM$ ; $C_{2x}, \sigma_y, I\mathcal{T}$ ; $\{R_5, R_8\}$ ;	$\{R_5, R_8\}$ ;	2; $i\sigma_3, i\sigma_0, -i\sigma_2$ ;		
	$\{R_6, R_7\}$ ;	2; $i\sigma_3, -i\sigma_0, -i\sigma_2$ ;		
$T$ ; $RA$ ; $C_{2x}, \sigma_y, I\mathcal{T}$ ; $\{R_5, R_8\}$ ;	$\{R_5, R_8\}$ ;	2; $i\sigma_3, i\sigma_0, -i\sigma_2$ ;		
	$\{R_6, R_7\}$ ;	2; $i\sigma_3, -i\sigma_0, -i\sigma_2$ ;		
$W$ ; $XR$ ; $C_{2z}, \sigma_y, I\mathcal{T}$ ; $\{R_5, R_5\}$ ;	$\{R_5, R_5\}$ ;	4; $i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,1}$ ;	DNL;	0

$\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
	$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
	$R_{13};$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
	$R_{14};$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T};$	$R_{19};$	4;	$-\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	P-DNL <sub>MA</sub> ;	
$Z; (00\frac{1}{2}); I, \sigma_{db}, C_{4z}^+, \mathcal{T};$	$\{R_{19}, R_{20}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0}+i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$	DP;	0
	$\{R_{21}, R_{22}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, -\frac{\Gamma_{0,0}+i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$	DP;	0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, \sigma_{db}, I, \mathcal{T};$	$\{R_{19}, R_{19}\};$	8;	$\frac{Q_{0,3,2}-iQ_{0,3,0}}{\sqrt{2}}, \frac{Q_{0,2,1}-Q_{0,2,3}}{\sqrt{2}}, Q_{0,1,0}, iQ_{2,1,0};$	OP;	0
$R; (0\frac{1}{2}\frac{1}{2}); C_{2x}, \sigma_y, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
	$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
$X; (0\frac{1}{2}0); C_{2y}, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XR</sub> ;	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$U; ZR; \sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$		
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$		
	$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$		
$V; MA; C_{4z}^+, \sigma_y, I\mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{3,0}+i\Gamma_{3,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{2,0};$	DNL;	0
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$S; ZA; \sigma_z, C_{2a}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$		
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$Y; XM; C_{2x}, \sigma_y, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$		
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$T; RA; \sigma_y, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$\Gamma_{0,3}, -\Gamma_{0,1}, -\Gamma_{2,3};$	DNL;	0
$W; XR; C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	4;	$i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0

## SG 131

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 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{C_{2x}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_7;$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{13};$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
	$R_{14};$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_7;$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{13};$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
	$R_{14};$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Z; (00\frac{1}{2}); C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_{19};$	4; $\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{-\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_{19};$	4; $\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{-\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$R; (0\frac{1}{2}\frac{1}{2}); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{10};$	2; $i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	2; $i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{10};$	2; $i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2; $i\sigma_2, i\sigma_1, -i\sigma_2;$
$U; ZR; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2; $i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
	$R_7;$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$V; MA; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
	$R_7;$	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2; $i\sigma_2, i\sigma_1, -i\sigma_2;$
$S; ZA; C_{2a}, \sigma_z, I\mathcal{T};$	$\{R_5, R_6\};$	2; $i\sigma_0, i\sigma_3, -i\sigma_2;$
	$\{R_7, R_8\};$	2; $-i\sigma_0, -i\sigma_3, -i\sigma_2;$
$Y; XM; C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	2; $i\sigma_2, i\sigma_1, -i\sigma_2;$
$T; RA; C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	2; $i\sigma_2, i\sigma_1, -i\sigma_2;$
$W; XR; C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	2; $i\sigma_2, i\sigma_1, -i\sigma_2;$



$\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{C_{2x}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{13};$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
	$R_{14};$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{13};$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
	$R_{14};$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Z; (00\frac{1}{2}); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_{19};$	$4; -\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_{19};$	$4; -\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$R; (0\frac{1}{2}\frac{1}{2}); \sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$X; (0\frac{1}{2}0); C_{2z}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$\Delta; \Gamma X; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$U; ZR; \sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$V; MA; C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$S; ZA; \sigma_{db}, C_{2a}, I, \mathcal{T};$	$R_9;$	$2; i\sigma_3, -i\sigma_1, -i\sigma_2;$
$Y; XM; C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$T; RA; \sigma_z, C_{2x}, I, \mathcal{T};$	$\{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$W; XR; C_{2z}, \sigma_y, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
	$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
	$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_{19};$	4;	$\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{-\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$Z; (00 \frac{1}{2}); C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_{19};$	4;	$\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{-\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); I, \sigma_x, C_{4z}^+, \mathcal{T};$	$\{R_{19}, R_{20}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0} + i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$ DP; 0
	$\{R_{21}, R_{22}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0} + i\Gamma_{0,2}}{-\sqrt{2}}, -i\Gamma_{2,0};$ DP; 0
$R; (0 \frac{1}{2} \frac{1}{2}); \sigma_x, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$X; (0 \frac{1}{2} 0); \sigma_x, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$ DP; 0
$\Delta; \Gamma X; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$U; ZR; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$V; MA; C_{4z}^+, \sigma_x, I, \mathcal{T};$	$R_6;$	2;	$\frac{-\sigma_1 - i\sigma_0}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$
	$R_7;$	2;	$\frac{i(\sigma_0 + i\sigma_1)}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$
$S; ZA; C_{2a}, \sigma_z, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$
	$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$
$Y; XM; \sigma_y, C_{2x}, I, \mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$
$T; RA; \sigma_y, C_{2x}, I, \mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$
$W; XR; \sigma_y, C_{2z}, I, \mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
	$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_{19};$	4;	$-\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	DP; 0
$Z; (00 \frac{1}{2}); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_{19};$	4;	$-\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	DP; 0
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
	$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$R; (0 \frac{1}{2} \frac{1}{2}); \sigma_y, \sigma_x, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$X; (0 \frac{1}{2} 0); \sigma_x, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$\Delta; \Gamma X; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$U; ZR; \sigma_z, C_{2y}, I, \mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$	
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$V; MA; C_{4z}^+, \sigma_x, I, \mathcal{T};$	$R_6;$	2;	$\frac{-\sigma_1 - i\sigma_0}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$	
	$R_7;$	2;	$\frac{i(\sigma_0 + i\sigma_1)}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$	
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$S; ZA; \sigma_{db}, C_{2a}, I, \mathcal{T};$	$R_9;$	2;	$i\sigma_3, -i\sigma_1, -i\sigma_2;$	
$Y; XM; \sigma_y, C_{2x}, I, \mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$	
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$T; RA; C_{2x}, \sigma_z, I, \mathcal{T};$	$R_9;$	2;	$i\sigma_3, -\sigma_1, -i\sigma_2;$	
$W; XR; \sigma_y, C_{2z}, I, \mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$	
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$	

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
		$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
		$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$M; (\frac{1}{2} \frac{1}{2} 0);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, \Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;	
		$\{R_{20}, R_{21}\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;	
$Z; (00\frac{1}{2});$	$C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_{19};$	4;	$-\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	DP;	0
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$C_{4z}^+, \sigma_{db}, I, \mathcal{T};$	$\{R_{19}, R_{19}\};$	8;	$\frac{Q_{0,3,2} - iQ_{0,3,0}}{\sqrt{2}}, \frac{Q_{0,2,1} - Q_{0,2,3}}{\sqrt{2}}, Q_{0,1,0}, iQ_{2,1,0};$	OP;	0
$R; (0\frac{1}{2} \frac{1}{2});$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>RA</sub> ;	
$X; (0\frac{1}{2} 0);$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XM</sub> ;	
$\Delta; \Gamma X;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$U; ZR;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$\Lambda; \Gamma Z;$	$C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$		
		$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$		
$V; MA;$	$C_{4z}^+, \sigma_x, I\mathcal{T};$	$\{R_6, R_7\};$	4;	$-\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, -\Gamma_{0,3}, -i\Gamma_{2,0};$	DNL;	0
$\Sigma; \Gamma M;$	$C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$S; ZA;$	$C_{2a}, \sigma_z, I\mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$		
$Y; XM;$	$\sigma_z, C_{2x}, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$T; RA;$	$\sigma_z, C_{2x}, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$W; XR;$	$\sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$		
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$		

$\Gamma_q; \{C_{4z}^+|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_{13};$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
		$R_{14};$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, \Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;
		$\{R_{20}, R_{21}\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;
$Z; (00\frac{1}{2});$	$C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_{19};$	4;	$-\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	DP; 0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T};$	$R_{19};$	4;	$-\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	P-DNL <sub>MA</sub> ;
$R; (0\frac{1}{2}\frac{1}{2});$	$C_{2y}, C_{2z}, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$\sigma_0, -i\sigma_3, \sigma_0, -i\sigma_2;$	
		$\{R_{15}, R_{16}\};$	2;	$-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$	
		$\{R_{17}, R_{18}\};$	2;	$\sigma_0, -i\sigma_3, -\sigma_0, -i\sigma_2;$	
$X; (0\frac{1}{2}0);$	$\sigma_x, C_{2z}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XM</sub> ;
$\Delta; \Gamma X;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$U; ZR;$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$	
		$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$\Lambda; \Gamma Z;$	$C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
		$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$V; MA;$	$C_{4z}^+, \sigma_x, I\mathcal{T};$	$\{R_6, R_7\};$	4;	$-\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, -\Gamma_{0,3}, -i\Gamma_{2,0};$	DNL; 0
$\Sigma; \Gamma M;$	$C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$S; ZA;$	$\sigma_{db}, C_{2a}, I\mathcal{T};$	$R_9;$	2;	$i\sigma_3, -i\sigma_1, -i\sigma_2;$	
$Y; XM;$	$\sigma_z, C_{2x}, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL; 0
$T; RA;$	$C_{2x}, \sigma_z, \bar{E}, I\mathcal{T};$	$\{R_6, R_9\};$	2;	$-i\sigma_3, -i\sigma_3, -\sigma_0, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$-i\sigma_3, i\sigma_3, -\sigma_0, -i\sigma_2;$	
$W; XR;$	$\sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$	

$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
	$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
	$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T};$	$R_{19};$	4;	$\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{-\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	P-DNL <sub>MA</sub> ;	
$Z; (00 \frac{1}{2}); C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_{19};$	4;	$\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{-\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	DP;	0
$A; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); I, \sigma_{db}, S_{4z}^+, \mathcal{T};$	$\{R_{19}, R_{20}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0} + i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$	P-DNL <sub>MA</sub> ;	
	$\{R_{21}, R_{22}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0} + i\Gamma_{0,2}}{-\sqrt{2}}, -i\Gamma_{2,0};$	P-DNL <sub>MA</sub> ;	
$R; (0 \frac{1}{2} \frac{1}{2}); C_{2y}, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XR</sub> ;	
$X; (0 \frac{1}{2} 0); C_{2y}, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XR</sub> ;	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$U; ZR; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$		
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$		
$V; MA; C_{4z}^+, \sigma_y, I\mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{3,0} + i\Gamma_{3,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{2,0};$	DNL;	0
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$S; ZA; C_{2a}, \sigma_z, I\mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$		
	$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$		
$Y; XM; C_{2x}, \sigma_z, I\mathcal{T};$	$\{R_5, R_7\};$	2;	$i\sigma_3, \sigma_3, -i\sigma_2;$		
	$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_3, -i\sigma_2;$		
$T; RA; C_{2x}, \sigma_z, I\mathcal{T};$	$\{R_5, R_7\};$	2;	$i\sigma_3, \sigma_3, -i\sigma_2;$		
	$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_3, -i\sigma_2;$		
$W; XR; C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	4;	$i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0

$\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
	$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$		
	$R_{13};$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
	$R_{14};$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, \sigma_x, \mathcal{T};$	$R_{19};$	4;	$-\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	P-DNL <sub>MA</sub> ;	
$Z; (00\frac{1}{2}); C_{4z}^+, \sigma_x, C_{2x}, \mathcal{T};$	$R_{19};$	4;	$-\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	DP;	0
$A; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, \Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;	
	$\{R_{20}, R_{21}\};$	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	P-DNLs;	
$R; (0\frac{1}{2}\frac{1}{2}); C_{2x}, \sigma_y, I, \mathcal{T};$	$\{R_9, R_9\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
	$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0};$	P-DNLs;	
$X; (0\frac{1}{2}0); C_{2y}, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>XR</sub> ;	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$U; ZR; \sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$		
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$		
$\Lambda; \Gamma Z; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$		
	$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$		
$V; MA; C_{4z}^+, \sigma_y, I\mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{3,0}+i\Gamma_{3,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{2,0};$	DNL;	0
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$S; ZA; \sigma_{db}, C_{2a}, I\mathcal{T};$	$R_9;$	2;	$i\sigma_3, -i\sigma_1, -i\sigma_2;$		
$Y; XM; C_{2x}, \sigma_z, I\mathcal{T};$	$\{R_5, R_7\};$	2;	$i\sigma_3, \sigma_3, -i\sigma_2;$		
	$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_3, -i\sigma_2;$		
$T; RA; \sigma_y, \sigma_z, I\mathcal{T};$	$\{R_9, R_9\};$	4;	$\Gamma_{0,3}, -\Gamma_{0,1}, -\Gamma_{2,3};$	DNL;	0
$W; XR; C_{2z}, \sigma_y, I\mathcal{T};$	$\{R_5, R_5\};$	4;	$i\Gamma_{0,2}, i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0

$\Gamma_q^v; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{13};$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
		$R_{14};$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$N; (0\frac{1}{2}0);$	$C_{2y}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$
		$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$X; (00\frac{1}{2});$	$C_{2z}, C_{2a}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{13};$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
		$R_{14};$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$V; ZV;$	$C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$W; XP;$	$C_{2z}, \sigma_{db}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Sigma; \Gamma Z/\Gamma \Sigma;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$F; ZF;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$Q; NP;$	$C_{2y}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$
$\Delta; \Gamma X;$	$C_{2a}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$U; ZU;$	$C_{2a}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$Y; XZ/XY;$	$C_{2b}, \sigma_{da}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$



$\Gamma_q^v; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{13};$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
		$R_{14};$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$N; (0 \frac{1}{2} 0);$	$\sigma_y, E, I, \mathcal{T};$	$\{R_9, R_9\};$	$4; \Gamma_{0,1}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$
$X; (00 \frac{1}{2});$	$C_{2z}, C_{2a}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$Z; (\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$
		$R_{13};$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
		$R_{14};$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$
$P; (\frac{1}{4} \frac{1}{4} \frac{1}{4});$	$S_{4z}^+, C_{2x}, I, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{3,0} + i\Gamma_{3,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{2,0};$
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$V; ZV;$	$C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
		$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$W; XP;$	$C_{2z}, \sigma_{db}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Sigma; \Gamma Z/\Gamma \Sigma;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$F; ZF;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, -i\sigma_1, -i\sigma_2;$
$Q; NP;$	$C_{2y}, I, \mathcal{T};$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$
		$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$
$\Delta; \Gamma X;$	$C_{2a}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$U; ZU;$	$C_{2a}, \sigma_z, I, \mathcal{T};$	$R_5;$	$2; -i\sigma_2, -i\sigma_1, -i\sigma_2;$
$Y; XZ/XY;$	$C_{2b}, \sigma_{da}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$

## SG 141

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 $\Gamma_q^v; \{C_{4z}^+|0\frac{1}{2}0\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_{13};$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
		$R_{14};$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$N; (0\frac{1}{2}0);$	$C_{2y}, I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, \sigma_0, -i\sigma_2;$	
		$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_0, -i\sigma_2;$	
$X; (00\frac{1}{2});$	$\sigma_{db}, \sigma_{da}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_{19};$	4;	$\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{-\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	DP; 0
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, \sigma_{db}, I, \mathcal{T};$	$\{R_9, R_{10}\};$	2;	$(-1)^{3/4}\sigma_0, (-1)^{3/4}\sigma_3, -i\sigma_2;$	
		$\{R_{11}, R_{12}\};$	2;	$-(-1)^{3/4}\sigma_0, (-1)^{3/4}\sigma_3, -i\sigma_2;$	
		$R_{19};$	2;	$\sqrt[4]{-1}\sigma_3, (-1)^{3/4}\sigma_2, -i\sigma_2;$	
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
		$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$V; ZV;$	$C_{4z}^+, \sigma_x, E, I, \mathcal{T};$	$R_{13};$	2;	$\frac{\sigma_2-i\sigma_0}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_{14};$	2;	$\frac{\sigma_2+i\sigma_0}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
$W; XP;$	$C_{2z}, \sigma_{db}, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, \sigma_3, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -\sigma_3, -i\sigma_2;$	
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$F; ZF;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	2;	$-i\sigma_2, i\sigma_1, -i\sigma_2;$	
$Q; NP;$	$C_{2y}, E, I, \mathcal{T};$	$\{R_5, R_7\};$	2;	$-i\sigma_3, \sigma_0, -i\sigma_2;$	
$\Delta; \Gamma X;$	$C_{2a}, \sigma_z, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$U; ZU;$	$C_{2a}, \sigma_z, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$	
$Y; XZ/XY;$	$C_{2b}, \sigma_{da}, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$	

$\Gamma_q^v; \{C_{4z}^+|\frac{1}{2}00\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_{13};$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
		$R_{14};$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$N; (0\frac{1}{2}0);$	$C_{2y}, E, I, \mathcal{T};$	$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP; 0
$X; (00\frac{1}{2});$	$\sigma_z, \sigma_{da}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$Z; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4z}^+, \sigma_{db}, C_{2b}, \mathcal{T};$	$R_{19};$	4;	$\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{-\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	DP; 0
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$S_{4z}^+, \sigma_{db}, I, \mathcal{T};$	$\{R_9, R_{12}\};$	2;	$(-1)^{3/4}\sigma_3, (-1)^{3/4}\sigma_3, -i\sigma_2;$	
		$\{R_{10}, R_{11}\};$	2;	$(-1)^{3/4}\sigma_3, -(-1)^{3/4}\sigma_3, -i\sigma_2;$	
		$\{R_{19}, R_{19}\};$	4;	$\sqrt[4]{-1}\Gamma_{0,3}, (-1)^{3/4}\Gamma_{0,2}, i\Gamma_{2,0};$	QDP; 0
$\Lambda; \Gamma\Lambda/\Gamma Z;$	$C_{4z}^+, \sigma_y, I, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
		$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$V; ZV;$	$C_{4z}^+, \sigma_x, E, I, \mathcal{T};$	$R_{13};$	2;	$\frac{i(\sigma_0+i\sigma_2)}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_{14};$	2;	$\frac{-\sigma_2-i\sigma_0}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
$W; XP;$	$C_{2z}, \sigma_{da}, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$	
$\Sigma; \Gamma Z/\Gamma\Sigma;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$F; ZF;$	$C_{2x}, \sigma_z, I, \mathcal{T};$	$R_5;$	2;	$-i\sigma_2, i\sigma_1, -i\sigma_2;$	
$Q; NP;$	$C_{2y}, E, I, \mathcal{T};$	$\{R_5, R_5\};$	2;	$-i\sigma_0, \sigma_0, -i\sigma_2;$	
		$\{R_7, R_7\};$	2;	$i\sigma_0, \sigma_0, -i\sigma_2;$	
$\Delta; \Gamma X;$	$C_{2a}, \sigma_z, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$U; ZU;$	$C_{2a}, \sigma_z, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$	
$Y; XZ/XY;$	$C_{2b}, \sigma_{da}, I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$	
		$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$	

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 $\Gamma_h; \{C_3^+|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; $(000)$ ; $C_3^+, \mathcal{T}$ ; $\{R_2, R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, -i\sigma_2$ ; C-1 WP; 1	
	$\{R_4, R_4\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-3 WP; 3
$M$ ; $(0\frac{1}{2}0)$ ; $\bar{E}, \mathcal{T}$ ; $\{R_2, R_2\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-1 WP; 1	
$A$ ; $(00\frac{1}{2})$ ; $C_3^+, \mathcal{T}$ ; $\{R_2, R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, -i\sigma_2$ ; C-1 WP; 1	
	$\{R_4, R_4\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-3 WP; 3
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $\bar{E}, \mathcal{T}$ ; $\{R_2, R_2\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-1 WP; 1	
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
	$R_4$ ; 1; $-1$ ;
	$R_6$ ; 1; $-(-1)^{2/3}$ ;
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
	$R_4$ ; 1; $-1$ ;
	$R_6$ ; 1; $-(-1)^{2/3}$ ;
$\Delta$ ; $\Gamma A$ ; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
	$R_4$ ; 1; $-1$ ;
	$R_6$ ; 1; $-(-1)^{2/3}$ ;
$U$ ; $ML$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$P$ ; $KH$ ; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
	$R_4$ ; 1; $-1$ ;
	$R_6$ ; 1; $-(-1)^{2/3}$ ;
$T$ ; $\Gamma K$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$S$ ; $AH$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$T'$ ; $MK$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$S'$ ; $LH$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$\Sigma$ ; $\Gamma M$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$R$ ; $AL$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	

SG 144

 $\Gamma_h$ ;  $\{C_3^+|00\frac{1}{3}\}$ ;  $\mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; $(000)$ ; $C_3^+$ ; $\mathcal{T}$ ; $\{R_2, R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, -i\sigma_2$ ; C-1 WP; 1	
$\{R_4, R_4\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-3 WP; 3	
$M$ ; $(0\frac{1}{2}0)$ ; $\bar{E}$ ; $\mathcal{T}$ ; $\{R_2, R_2\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-1 WP; 1	
$A$ ; $(00\frac{1}{2})$ ; $C_3^-$ ; $\mathcal{T}$ ; $\{R_2, R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, -i\sigma_2$ ; C-1 WP; 1	
$\{R_4, R_4\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-3 WP; 3	
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $\bar{E}$ ; $\mathcal{T}$ ; $\{R_2, R_2\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-1 WP; 1	
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
$R_4$ ; 1; $-1$ ;	
$R_6$ ; 1; $-(-1)^{2/3}$ ;	
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^-$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
$R_4$ ; 1; $-1$ ;	
$R_6$ ; 1; $-(-1)^{2/3}$ ;	
$\Delta$ ; $\Gamma A$ ; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
$R_4$ ; 1; $-1$ ;	
$R_6$ ; 1; $-(-1)^{2/3}$ ;	
$U$ ; $ML$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$P$ ; $KH$ ; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
$R_4$ ; 1; $-1$ ;	
$R_6$ ; 1; $-(-1)^{2/3}$ ;	
$T$ ; $\Gamma K$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$S$ ; $AH$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$T'$ ; $MK$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$S'$ ; $LH$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$\Sigma$ ; $\Gamma M$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$R$ ; $AL$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	

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 $\Gamma_h; \{C_3^+ | 00\frac{2}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; $(000)$ ; $C_3^+, \mathcal{T}$ ; $\{R_2, R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, -i\sigma_2$ ; C-1 WP; 1	
	$\{R_4, R_4\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-3 WP; 3
$M$ ; $(0\frac{1}{2}0)$ ; $\bar{E}, \mathcal{T}$ ; $\{R_2, R_2\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-1 WP; 1	
$A$ ; $(00\frac{1}{2})$ ; $C_3^+, \mathcal{T}$ ; $\{R_2, R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, -i\sigma_2$ ; C-1 WP; 1	
	$\{R_4, R_4\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-3 WP; 3
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $\bar{E}, \mathcal{T}$ ; $\{R_2, R_2\}$ ; 2; $-\sigma_0, -i\sigma_2$ ; C-1 WP; 1	
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
	$R_4$ ; 1; $-1$ ;
	$R_6$ ; 1; $-(-1)^{2/3}$ ;
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
	$R_4$ ; 1; $-1$ ;
	$R_6$ ; 1; $-(-1)^{2/3}$ ;
$\Delta$ ; $\Gamma A$ ; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
	$R_4$ ; 1; $-1$ ;
	$R_6$ ; 1; $-(-1)^{2/3}$ ;
$U$ ; $ML$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$P$ ; $KH$ ; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;	
	$R_4$ ; 1; $-1$ ;
	$R_6$ ; 1; $-(-1)^{2/3}$ ;
$T$ ; $\Gamma K$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$S$ ; $AH$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$T'$ ; $MK$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$S'$ ; $LH$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$\Sigma$ ; $\Gamma M$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	
$R$ ; $AL$ ; $\bar{E}$ ; $R_2$ ; 1; $-1$ ;	

SG 146

 $\Gamma_{rh}; \{C_3^+|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma;$	$(000);$	$C_3^+; \mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
			$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$	C-3 WP; 3
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_3^+; \mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
			$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$	C-3 WP; 3
$L;$	$(0\frac{1}{2}0);$	$\bar{E}; \mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	C-1 WP; 1
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$\bar{E}; \mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	C-1 WP; 1
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$\bar{E}; \mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	C-1 WP; 1
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+;$	$R_2;$	$1; \sqrt[3]{-1};$	
			$R_4;$	$1; -1;$	
			$R_6;$	$1; -(-1)^{2/3};$	
$P;$	$ZP;$	$C_3^+;$	$R_2;$	$1; \sqrt[3]{-1};$	
			$R_4;$	$1; -1;$	
			$R_6;$	$1; -(-1)^{2/3};$	
$B;$	$ZB;$	$\bar{E};$	$R_2;$	$1; -1;$	
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$\bar{E};$	$R_2;$	$1; -1;$	
$Q;$	$FQ;$	$\bar{E};$	$R_2;$	$1; -1;$	
$Y;$	$LZ/LY;$	$\bar{E};$	$R_2;$	$1; -1;$	

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 $\Gamma_h; \{S_6^+|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

- $\Gamma; (000); S_6^+, I, \mathcal{T}; \{R_2, R_6\}; 2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0, -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, \sigma_0, -i\sigma_2;$   
 $\{R_7, R_7\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$   
 $\{R_9, R_{11}\}; 2; \frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), -\sigma_0, -i\sigma_2;$
- $M; (0\frac{1}{2}0); I, \bar{E}, \mathcal{T}; \{R_2, R_2\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$
- $A; (00\frac{1}{2}); S_6^+, I, \mathcal{T}; \{R_2, R_6\}; 2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0, -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, \sigma_0, -i\sigma_2;$   
 $\{R_7, R_7\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$   
 $\{R_9, R_{11}\}; 2; \frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), -\sigma_0, -i\sigma_2;$
- $L; (0\frac{1}{2}\frac{1}{2}); I, \bar{E}, \mathcal{T}; \{R_2, R_2\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$
- $K; (\frac{1}{3}\frac{2}{3}0); C_3^+, I\mathcal{T}; \{R_2, R_6\}; 2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, -i\sigma_2;$
- $H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, I\mathcal{T}; \{R_2, R_6\}; 2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, -i\sigma_2;$
- $\Delta; \Gamma A; C_3^+, I\mathcal{T}; \{R_2, R_6\}; 2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, -i\sigma_2;$
- $U; ML; \bar{E}, I\mathcal{T}; \{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$
- $P; KH; C_3^+, I\mathcal{T}; \{R_2, R_6\}; 2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$   
 $\{R_4, R_4\}; 2; -\sigma_0, -i\sigma_2;$
- $T; \Gamma K; \bar{E}, I\mathcal{T}; \{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$
- $S; AH; \bar{E}, I\mathcal{T}; \{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$
- $T'; MK; \bar{E}, I\mathcal{T}; \{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$
- $S'; LH; \bar{E}, I\mathcal{T}; \{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$
- $\Sigma; \Gamma M; \bar{E}, I\mathcal{T}; \{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$
- $R; AL; \bar{E}, I\mathcal{T}; \{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$



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 $\Gamma_{rh}; \{S_6^+|000\}, \{I|000\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$\Gamma;$	$(000);$	$S_6^+, I, \mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0, -i\sigma_2;$
			$\{R_4, R_4\};$	$2; -\sigma_0, \sigma_0, -i\sigma_2;$
			$\{R_7, R_7\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$
			$\{R_9, R_{11}\};$	$2; \frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), -\sigma_0, -i\sigma_2;$
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_6^+, I, \mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0, -i\sigma_2;$
			$\{R_4, R_4\};$	$2; -\sigma_0, \sigma_0, -i\sigma_2;$
			$\{R_7, R_7\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$
			$\{R_9, R_{11}\};$	$2; \frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), -\sigma_0, -i\sigma_2;$
$L;$	$(0\frac{1}{2}0);$	$I, \bar{E}, \mathcal{T};$	$\{R_2, R_2\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$
			$\{R_4, R_4\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$I, \bar{E}, \mathcal{T};$	$\{R_2, R_2\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$
			$\{R_4, R_4\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$I, \bar{E}, \mathcal{T};$	$\{R_2, R_2\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$
			$\{R_4, R_4\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, I\mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$
			$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$
$P;$	$ZP;$	$C_3^+, I\mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$
			$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$
$B;$	$ZB;$	$\bar{E}, I\mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$\bar{E}, I\mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$
$Q;$	$FQ;$	$\bar{E}, I\mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$
$Y;$	$LZ/LY;$	$\bar{E}, I\mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$

$\Gamma_h; \{C_3^+|000\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}', \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$M;$	$(0\frac{1}{2}0);$	$C_{21}', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$A;$	$(00\frac{1}{2});$	$C_3^+, C_{21}', \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$\Delta;$	$\Gamma A;$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$U;$	$ML;$	$\bar{E}, C_{21}', \mathcal{T};$	$R_2;$	$1; -1, 1;$	
$P;$	$KH;$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$T;$	$\Gamma K;$	$\bar{E}, C_{22}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$S;$	$AH;$	$\bar{E}, C_{22}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$T';$	$MK;$	$\bar{E}, C_{21}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$S';$	$LH;$	$\bar{E}, C_{21}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$\Sigma;$	$\Gamma M;$	$C_{21}';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	
$R;$	$AL;$	$C_{21}';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	

SG 150

 $\Gamma_h; \{C_3^+|000\}, \{C_{21}''|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}'', \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$M;$	$(0\frac{1}{2}0);$	$C_{21}'', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$A;$	$(00\frac{1}{2});$	$C_3^+, C_{21}'', \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}'', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, C_{21}'';$	$R_3;$	$1; -1, i;$	
			$R_4;$	$1; -1, -i;$	
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	C-1 WP; 1
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, C_{21}'';$	$R_3;$	$1; -1, i;$	
			$R_4;$	$1; -1, -i;$	
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	C-1 WP; 1
$\Delta;$	$\Gamma A;$	$C_3^+, C_{22}''\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$U;$	$ML;$	$\bar{E}, C_{21}'', \mathcal{T};$	$R_2;$	$1; -1, 1;$	
$P;$	$KH;$	$C_3^+;$	$R_2;$	$1; \sqrt[3]{-1};$	
			$R_4;$	$1; -1;$	
			$R_6;$	$1; -(-1)^{2/3};$	
$T;$	$\Gamma K;$	$C_{22}'';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	
$S;$	$AH;$	$C_{22}'';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	
$T';$	$MK;$	$C_{21}'';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	
$S';$	$LH;$	$C_{21}'';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	
$\Sigma;$	$\Gamma M;$	$\bar{E}, C_{21}'', \mathcal{T};$	$R_2;$	$1; -1, 1;$	
$R;$	$AL;$	$\bar{E}, C_{21}'', \mathcal{T};$	$R_2;$	$1; -1, 1;$	

SG 151

 $\Gamma_h; \{C_3^+|00\frac{1}{3}\}, \{C_{21}'|00\frac{2}{3}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}', \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$M;$	$(0\frac{1}{2}0);$	$C_{21}', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$A;$	$(00\frac{1}{2});$	$C_3^-, C_{21}', \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^-, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$\Delta;$	$\Gamma A;$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$U;$	ML;	$\bar{E}, C_{21}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$P;$	KH;	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$T;$	$\Gamma K;$	$\bar{E}, C_{22}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$S;$	AH;	$\bar{E}, C_{22}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$T';$	MK;	$\bar{E}, C_{21}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$S';$	LH;	$\bar{E}, C_{21}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$\Sigma;$	$\Gamma M;$	$C_{21}';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	
$R;$	AL;	$C_{21}';$	$R_2;$	$1; -i;$	
			$R_8;$	$1; i;$	

SG 152

 $\Gamma_h; \{C_3^+|00\frac{1}{3}\}, \{C_{21}''|00\frac{2}{3}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}'', \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$M;$	$(0\frac{1}{2}0);$	$C_{21}'', \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$A;$	$(00\frac{1}{2});$	$C_3^-, C_{21}'', \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}'', \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, C_{21}'';$	$R_3;$	1;	$-1, i;$	
			$R_4;$	1;	$-1, -i;$	
			$R_6;$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	C-1 WP; 1
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^-, C_{21}'';$	$R_3;$	1;	$-1, i;$	
			$R_4;$	1;	$-1, -i;$	
			$R_6;$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	C-1 WP; 1
$\Delta;$	$\Gamma A;$	$C_3^+, C_{22}'', \mathcal{T};$	$R_2;$	1;	$\sqrt[3]{-1}, 1;$	
			$R_4;$	1;	$-1, 1;$	
			$R_6;$	1;	$-(-1)^{2/3}, 1;$	
$U;$	$ML;$	$\bar{E}, C_{21}'', \mathcal{T};$	$R_2;$	1;	$-1, 1;$	
$P;$	$KH;$	$C_3^+;$	$R_2;$	1;	$\sqrt[3]{-1};$	
			$R_4;$	1;	$-1;$	
			$R_6;$	1;	$-(-1)^{2/3};$	
$T;$	$\Gamma K;$	$C_{22}'';$	$R_2;$	1;	$i;$	
			$R_4;$	1;	$-i;$	
$S;$	$AH;$	$C_{22}'';$	$R_6;$	1;	$i;$	
			$R_{12};$	1;	$-i;$	
$T';$	$MK;$	$C_{21}'';$	$R_2;$	1;	$i;$	
			$R_4;$	1;	$-i;$	
$S';$	$LH;$	$C_{21}'';$	$R_2;$	1;	$-i;$	
			$R_8;$	1;	$i;$	
$\Sigma;$	$\Gamma M;$	$\bar{E}, C_{21}'', \mathcal{T};$	$R_2;$	1;	$-1, 1;$	
$R;$	$AL;$	$\bar{E}, C_{21}'', \mathcal{T};$	$R_2;$	1;	$-1, 1;$	

SG 153

 $\Gamma_h; \{C_3^+|00\frac{2}{3}\}, \{C_{21}'|00\frac{1}{3}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}', \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$M;$	$(0\frac{1}{2}0);$	$C_{21}', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$A;$	$(00\frac{1}{2});$	$C_3^+, C_{21}', \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$\Delta;$	$\Gamma A;$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$U;$	$ML;$	$\bar{E}, C_{21}', \mathcal{T};$	$R_2;$	$1; -1, 1;$	
$P;$	$KH;$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$T;$	$\Gamma K;$	$\bar{E}, C_{22}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$S;$	$AH;$	$\bar{E}, C_{22}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$T';$	$MK;$	$\bar{E}, C_{21}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$S';$	$LH;$	$\bar{E}, C_{21}'\mathcal{T};$	$R_2;$	$1; -1, 1;$	
$\Sigma;$	$\Gamma M;$	$C_{21}';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	
$R;$	$AL;$	$C_{21}';$	$R_6;$	$1; i;$	
			$R_{12};$	$1; -i;$	

SG 154

 $\Gamma_h; \{C_3^+|00\frac{2}{3}\}, \{C_{21}''|00\frac{1}{3}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}'', \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$M;$	$(0\frac{1}{2}0);$	$C_{21}'', \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$A;$	$(00\frac{1}{2});$	$C_3^+, C_{21}'', \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}'', \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, C_{21}'';$	$R_3;$	1;	$-1, i;$	
			$R_4;$	1;	$-1, -i;$	
			$R_6;$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	C-1 WP; 1
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, C_{21}'';$	$R_3;$	1;	$-1, i;$	
			$R_4;$	1;	$-1, -i;$	
			$R_6;$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	C-1 WP; 1
$\Delta;$	$\Gamma A;$	$C_3^+, C_{22}'', \mathcal{T};$	$R_2;$	1;	$\sqrt[3]{-1}, 1;$	
			$R_4;$	1;	$-1, 1;$	
			$R_6;$	1;	$-(-1)^{2/3}, 1;$	
$U;$	$ML;$	$\bar{E}, C_{21}'', \mathcal{T};$	$R_2;$	1;	$-1, 1;$	
$P;$	$KH;$	$C_3^+;$	$R_2;$	1;	$\sqrt[3]{-1};$	
			$R_4;$	1;	$-1;$	
			$R_6;$	1;	$-(-1)^{2/3};$	
$T;$	$\Gamma K;$	$C_{22}'';$	$R_2;$	1;	$i;$	
			$R_4;$	1;	$-i;$	
$S;$	$AH;$	$C_{22}'';$	$R_2;$	1;	$-i;$	
			$R_8;$	1;	$i;$	
$T';$	$MK;$	$C_{21}'';$	$R_2;$	1;	$i;$	
			$R_4;$	1;	$-i;$	
$S';$	$LH;$	$C_{21}'';$	$R_6;$	1;	$i;$	
			$R_{12};$	1;	$-i;$	
$\Sigma;$	$\Gamma M;$	$\bar{E}, C_{21}'', \mathcal{T};$	$R_2;$	1;	$-1, 1;$	
$R;$	$AL;$	$\bar{E}, C_{21}'', \mathcal{T};$	$R_2;$	1;	$-1, 1;$	

SG 155

 $\Gamma_{rh}; \{C_3^+|000\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}', \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_3^+, C_{21}', \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$L;$	$(0\frac{1}{2}0);$	$C_{22}', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$C_{23}', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$P;$	$ZP;$	$C_3^+, C_{22}'\mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
			$R_4;$	$1; -1, 1;$	
			$R_6;$	$1; -(-1)^{2/3}, 1;$	
$B;$	$ZB;$	$C_{21}';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$C_{21}';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	
$Q;$	$FQ;$	$C_{23}';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	
$Y;$	$LZ/LY;$	$C_{22}';$	$R_2;$	$1; i;$	
			$R_4;$	$1; -i;$	



$\Gamma_h; \{C_3^+|000\}, \{\sigma_{v1}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+; \sigma_{v1}, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNLs;	
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	P-WNL $_{\Gamma A}$ ;	
$M;$	$(0\frac{1}{2}0);$	$\sigma_{v1}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	P-WNL;	
$A;$	$(00\frac{1}{2});$	$C_3^+; \sigma_{v1}, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNLs;	
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	P-WNL $_{\Gamma A}$ ;	
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_{v1}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	P-WNL;	
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+; \mathcal{T}\sigma_{v2};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$		
			$R_4;$	$1; -1, 1;$		
			$R_6;$	$1; -(-1)^{2/3}, 1;$		
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+; \mathcal{T}\sigma_{v2};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$		
			$R_4;$	$1; -1, 1;$		
			$R_6;$	$1; -(-1)^{2/3}, 1;$		
$\Delta;$	$\Gamma A;$	$C_3^+; \sigma_{v1};$	$R_3;$	$1; -1, i;$		
			$R_4;$	$1; -1, -i;$		
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	WNL;	$\pi$
$U;$	ML;	$\sigma_{v1};$	$R_2;$	$1; i;$		
			$R_4;$	$1; -i;$		
$P;$	KH;	$C_3^+;$	$R_2;$	$1; \sqrt[3]{-1};$		
			$R_4;$	$1; -1;$		
			$R_6;$	$1; -(-1)^{2/3};$		
$T;$	$\Gamma K;$	$\bar{E}, \mathcal{T}\sigma_{v2};$	$R_2;$	$1; -1, 1;$		
$S;$	AH;	$\bar{E}, \mathcal{T}\sigma_{v2};$	$R_2;$	$1; -1, 1;$		
$T';$	MK;	$\bar{E}, \mathcal{T}\sigma_{v1};$	$R_2;$	$1; -1, 1;$		
$S';$	LH;	$\bar{E}, \mathcal{T}\sigma_{v1};$	$R_2;$	$1; -1, 1;$		
$\Sigma;$	$\Gamma M;$	$\sigma_{v1};$	$R_2;$	$1; i;$		
			$R_4;$	$1; -i;$		
$R;$	AL;	$\sigma_{v1};$	$R_2;$	$1; i;$		
			$R_4;$	$1; -i;$		

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 $\Gamma_h; \{C_3^+|000\}, \{\sigma_{d1}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma$ ; $(000)$ ; $C_3^+, \sigma_{d1}, \mathcal{T}$ ; $\{R_3, R_4\}$ ; 2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ; P-WNLs;	
$R_6$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2$ ; P-WNL;	
$M$ ; $(0\frac{1}{2}0)$ ; $\sigma_{d1}, \mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ; P-WNL;	
$A$ ; $(00\frac{1}{2})$ ; $C_3^+, \sigma_{d1}, \mathcal{T}$ ; $\{R_3, R_4\}$ ; 2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ; P-WNLs;	
$R_6$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2$ ; P-WNL $_{\Gamma A}$ ;	
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $\sigma_{d1}, \mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ; P-WNL;	
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+, \sigma_{d1}$ ; $R_3$ ; 1; $-1, i$ ;	
$R_4$ ; 1; $-1, -i$ ;	
$R_6$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3$ ; P-WNL $_{KH}$ ;	
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^+, \sigma_{d1}$ ; $R_3$ ; 1; $-1, i$ ;	
$R_4$ ; 1; $-1, -i$ ;	
$R_6$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3$ ; P-WNL $_{KH}$ ;	
$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{d1}$ ; $R_3$ ; 1; $-1, i$ ;	
$R_4$ ; 1; $-1, -i$ ;	
$R_6$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3$ ; WNL; $\pi$	
$U$ ; $ML$ ; $\sigma_{d1}$ ; $R_2$ ; 1; $i$ ;	
$R_4$ ; 1; $-i$ ;	
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}$ ; $R_3$ ; 1; $-1, i$ ;	
$R_4$ ; 1; $-1, -i$ ;	
$R_6$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3$ ; WNL; $\pi$	
$T$ ; $\Gamma K$ ; $\sigma_{d2}$ ; $R_2$ ; 1; $i$ ;	
$R_4$ ; 1; $-i$ ;	
$S$ ; $AH$ ; $\sigma_{d2}$ ; $R_2$ ; 1; $i$ ;	
$R_4$ ; 1; $-i$ ;	
$T'$ ; $MK$ ; $\sigma_{d1}$ ; $R_2$ ; 1; $i$ ;	
$R_4$ ; 1; $-i$ ;	
$S'$ ; $LH$ ; $\sigma_{d1}$ ; $R_2$ ; 1; $i$ ;	
$R_4$ ; 1; $-i$ ;	
$\Sigma$ ; $\Gamma M$ ; $\bar{E}, \mathcal{T}\sigma_{d1}$ ; $R_2$ ; 1; $-1, 1$ ;	
$R$ ; $AL$ ; $\bar{E}, \mathcal{T}\sigma_{d1}$ ; $R_2$ ; 1; $-1, 1$ ;	

$\Gamma_h; \{C_3^+|000\}, \{\sigma_{v1}|00\frac{1}{2}\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; $(000)$ ; $C_3^+, \sigma_{v1}, \mathcal{T}$ ; $\{R_3, R_4\}$ ; 2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-WNLs;	
$R_6$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2$ ;	P-WNL $_{\Gamma A}$ ;	
$M$ ; $(0\frac{1}{2}0)$ ; $\sigma_{v1}, \mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	P-WNL;	
$A$ ; $(00\frac{1}{2})$ ; $C_3^+, \sigma_{v1}, \mathcal{T}$ ; $\{R_1, R_1\}$ ; 2; $\sigma_0, \sigma_0, -i\sigma_2$ ;	P-WNLs;	
$\{R_2, R_2\}$ ; 2; $\sigma_0, -\sigma_0, -i\sigma_2$ ;	P-WNLs;	
$\{R_5, R_5\}$ ; 4; $\frac{\Gamma_{0,0} + i\sqrt{3}\Gamma_{0,2}}{-2}, \Gamma_{0,3}, i\Gamma_{2,0}$ ; DP;	0	
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $\sigma_{v1}, \mathcal{T}$ ; $\{R_1, R_1\}$ ; 2; $\sigma_0, -i\sigma_2$ ;	P-WNL $_{LH}$ ;	
$\{R_3, R_3\}$ ; 2; $-\sigma_0, -i\sigma_2$ ;	P-WNL $_{LH}$ ;	
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+, \mathcal{T}\sigma_{v2}$ ; $R_2$ ; 1; $\sqrt[3]{-1}, 1$ ;		
$R_4$ ; 1; $-1, 1$ ;		
$R_6$ ; 1; $-(-1)^{2/3}, 1$ ;		
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^+, \mathcal{T}\sigma_{v2}$ ; $\{R_2, R_2\}$ ; 2; $\sqrt[3]{-1}\sigma_0, -i\sigma_2$ ;	P-WNLs;	
$\{R_4, R_4\}$ ; 2; $-\sigma_0, -i\sigma_2$ ;	P-WNLs;	
$\{R_6, R_6\}$ ; 2; $-(-1)^{2/3}\sigma_0, -i\sigma_2$ ;	P-WNLs;	
$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}$ ; $R_3$ ; 1; $-1, i$ ;		
$R_4$ ; 1; $-1, -i$ ;		
$R_6$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3$ ;	WNL;	$\pi$
$U$ ; ML; $\sigma_{v1}$ ; $R_2$ ; 1; $i$ ;		
$R_4$ ; 1; $-i$ ;		
$P$ ; KH; $C_3^+$ ; $R_2$ ; 1; $\sqrt[3]{-1}$ ;		
$R_4$ ; 1; $-1$ ;		
$R_6$ ; 1; $-(-1)^{2/3}$ ;		
$T$ ; $\Gamma K$ ; $\bar{E}, \mathcal{T}\sigma_{v2}$ ; $R_2$ ; 1; $-1, 1$ ;		
$S$ ; AH; $\bar{E}, \mathcal{T}\sigma_{v2}$ ; $\{R_2, R_2\}$ ; 2; $-\sigma_0, -i\sigma_2$ ;	WNL;	$\pi$
$T'$ ; MK; $\bar{E}, \mathcal{T}\sigma_{v1}$ ; $R_2$ ; 1; $-1, 1$ ;		
$S'$ ; LH; $\bar{E}, \mathcal{T}\sigma_{v1}$ ; $\{R_2, R_2\}$ ; 2; $-\sigma_0, -i\sigma_2$ ;	WNL;	$\pi$
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}$ ; $R_2$ ; 1; $i$ ;		
$R_4$ ; 1; $-i$ ;		
$R$ ; AL; $\sigma_{v1}$ ; $R_2$ ; 1; 1;		
$R_4$ ; 1; $-1$ ;		

$\Gamma_h; \{C_3^+|000\}, \{\sigma_{d1}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, \sigma_{d1}, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNLs;	
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	P-WNL $_{\Gamma\Lambda/\Gamma Z}$ ;	
$M;$	$(0\frac{1}{2}0);$	$\sigma_{d1}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	P-WNL;	
$A;$	$(00\frac{1}{2});$	$C_3^+, \sigma_{d1}, \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, \sigma_0, -i\sigma_2;$	P-WNLs;	
			$\{R_2, R_2\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$	P-WNLs;	
			$\{R_5, R_5\};$	$4; \frac{\Gamma_{0,0} + i\sqrt{3}\Gamma_{0,2}}{-2}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP;	0
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_{d1}, \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-WNL $_{AL}$ ;	
			$\{R_3, R_3\};$	$2; -\sigma_0, -i\sigma_2;$	P-WNL $_{AL}$ ;	
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, \sigma_{d1};$	$R_3;$	$1; -1, i;$		
			$R_4;$	$1; -1, -i;$		
			$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, \sigma_{d1};$	$R_1;$	$1; 1, 1;$		
			$R_2;$	$1; 1, -1;$		
			$R_5;$	$2; \frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3;$	WNL;	$\pi$
$\Delta;$	$\Gamma A;$	$C_3^+, \sigma_{d1};$	$R_3;$	$1; -1, i;$		
			$R_4;$	$1; -1, -i;$		
			$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$U;$	ML;	$\sigma_{d1};$	$R_2;$	$1; i;$		
			$R_4;$	$1; -i;$		
$P;$	KH;	$C_3^+, \sigma_{d1};$	$R_3;$	$1; -1, i;$		
			$R_4;$	$1; -1, -i;$		
			$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$T;$	$\Gamma K;$	$\sigma_{d2};$	$R_2;$	$1; i;$		
			$R_4;$	$1; -i;$		
$S;$	AH;	$\sigma_{d2};$	$R_2;$	$1; 1;$		
			$R_4;$	$1; -1;$		
$T';$	MK;	$\sigma_{d1};$	$R_2;$	$1; i;$		
			$R_4;$	$1; -i;$		
$S';$	LH;	$\sigma_{d1};$	$R_2;$	$1; 1;$		
			$R_4;$	$1; -1;$		
$\Sigma;$	$\Gamma M;$	$\bar{E}, \mathcal{T}\sigma_{d1};$	$R_2;$	$1; -1, 1;$		
$R;$	AL;	$\bar{E}, \mathcal{T}\sigma_{d1};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	WNL;	$\pi$

SG 160

 $\Gamma_{rh}; \{C_3^+|000\}, \{\sigma_{d1}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, \sigma_{d1}, \mathcal{T};$	$\{R_3, R_4\};$	$2;$	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNLs;	
			$R_6;$	$2;$	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	P-WNL $_{\Gamma\Lambda/\Gamma Z}$ ;	
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_3^+, \sigma_{d1}, \mathcal{T};$	$\{R_3, R_4\};$	$2;$	$-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNLs;	
			$R_6;$	$2;$	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	P-WNL $_{\Gamma\Lambda/\Gamma Z}$ ;	
$L;$	$(0\frac{1}{2}0);$	$\sigma_{d2}, \mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, -i\sigma_2;$	P-WNL;	
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_{d1}, \mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, -i\sigma_2;$	P-WNL;	
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$\sigma_{d3}, \mathcal{T};$	$\{R_2, R_4\};$	$2;$	$i\sigma_3, -i\sigma_2;$	P-WNL;	
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, \sigma_{d1};$	$R_3;$	$1;$	$-1, i;$		
			$R_4;$	$1;$	$-1, -i;$		
			$R_6;$	$2;$	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	WNL;	$\pi$
$P;$	$ZP;$	$C_3^+, \sigma_{d1};$	$R_3;$	$1;$	$-1, -1;$		
			$R_4;$	$1;$	$-1, 1;$		
			$R_6;$	$2;$	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, -\sigma_3;$	WNL;	$\pi$
$B;$	$ZB;$	$\bar{E}, \mathcal{T}\sigma_{d1};$	$R_2;$	$1;$	$-1, 1;$		
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$\bar{E}, \mathcal{T}\sigma_{d1};$	$R_2;$	$1;$	$-1, 1;$		
$Q;$	$FQ;$	$\bar{E}, \mathcal{T}\sigma_{d3};$	$R_2;$	$1;$	$-1, 1;$		
$Y;$	$LZ/LY;$	$\bar{E}, \mathcal{T}\sigma_{d2};$	$R_2;$	$1;$	$-1, 1;$		

SG 161

 $\Gamma_{rh}; \{C_3^+|000\}, \{\sigma_{d1}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, \sigma_{d1}, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNLs;	
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	P-WNL $_{\Gamma\Lambda/\Gamma Z}$ ;	
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_3^+, \sigma_{d1}, \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, \sigma_0, -i\sigma_2;$	P-WNLs;	
			$\{R_2, R_2\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$	P-WNLs;	
			$\{R_5, R_5\};$	$4; \frac{\Gamma_{0,0} + i\sqrt{3}\Gamma_{0,2}}{-2}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP;	0
$L;$	$(0\frac{1}{2}0);$	$\sigma_{d2}, \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-WNL $_{LZ/LY}$ ;	
			$\{R_3, R_3\};$	$2; -\sigma_0, -i\sigma_2;$	P-WNL $_{LZ/LY}$ ;	
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$\sigma_{d1}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	P-WNL;	
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$\sigma_{d3}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	P-WNL;	
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, \sigma_{d1};$	$R_3;$	$1; -1, i;$		
			$R_4;$	$1; -1, -i;$		
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	WNL;	$\pi$
$P;$	$ZP;$	$C_3^+, \sigma_{d1};$	$R_3;$	$1; -1, 1;$		
			$R_4;$	$1; -1, -1;$		
			$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	WNL;	$\pi$
$B;$	$ZB;$	$\bar{E}, \mathcal{T}\sigma_{d1};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	WNL;	$\pi$
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$\bar{E}, \mathcal{T}\sigma_{d1};$	$R_2;$	$1; -1, 1;$		
$Q;$	$FQ;$	$\bar{E}, \mathcal{T}\sigma_{d3};$	$R_2;$	$1; -1, 1;$		
$Y;$	$LZ/LY;$	$\bar{E}, \mathcal{T}\sigma_{d2};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	WNL;	$\pi$

$\Gamma_h; \{C_3^+|000\}, \{C_{21}'|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}', I, \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_9, R_{10}\};$	2;	$-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$
			$R_{12};$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -\sigma_0, -i\sigma_2;$
$M;$	$(0\frac{1}{2}0);$	$C_{21}', I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_0, -i\sigma_2;$
$A;$	$(00\frac{1}{2});$	$C_3^+, C_{21}', I, \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_9, R_{10}\};$	2;	$-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$
			$R_{12};$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -\sigma_0, -i\sigma_2;$
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}', I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_0, -i\sigma_2;$
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, \sigma_{d1}, I\mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, \sigma_{d1}, I\mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$
$\Delta;$	$\Gamma A;$	$C_3^+, \sigma_{d1}, I\mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$
$U;$	$ML;$	$\sigma_{d1}, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$
$P;$	$KH;$	$C_3^+, \sigma_{d1}, I\mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$
$T;$	$\Gamma K;$	$\sigma_{d2}, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$
$S;$	$AH;$	$\sigma_{d2}, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$
$T';$	$MK;$	$\sigma_{d1}, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$
$S';$	$LH;$	$\sigma_{d1}, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$
$\Sigma;$	$\Gamma M;$	$C_{21}', I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$
$R;$	$AL;$	$C_{21}', I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$

$\Gamma_h; \{C_3^+|000\}, \{C_{21}'|00\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}', I, \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$	
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, \sigma_0, -i\sigma_2;$	
			$\{R_9, R_{10}\};$	2;	$-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$	
			$R_{12};$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -\sigma_0, -i\sigma_2;$	
$M;$	$(0\frac{1}{2}0);$	$C_{21}', I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, \sigma_0, -i\sigma_2;$	
			$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_0, -i\sigma_2;$	
$A;$	$(00\frac{1}{2});$	$\bar{C}_3^+, C_{21}', I, \mathcal{T};$	$\{R_{10}, R_{10}\};$	4;	$-\Gamma_{0,0}, i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	CDP; 0
			$\{R_{17}, R_{18}\};$	4;	$\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, i\Gamma_{3,1}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}', E, I, \mathcal{T};$	$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP; 0
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, \sigma_{d1}, I\mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, \sigma_{d1}, I\mathcal{T};$	$\{R_1, R_2\};$	2;	$\sigma_0, \sigma_3, -i\sigma_2;$	
			$R_5;$	2;	$\frac{1}{2}(-\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -i\sigma_2;$	
$\Delta;$	$\Gamma A;$	$C_3^+, \sigma_{d1}, I\mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
$U;$	ML;	$\sigma_{d1}, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	
$P;$	KH;	$C_3^+, \sigma_{d1}, I\mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
$T;$	$\Gamma K;$	$\sigma_{d2}, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	
$S;$	AH;	$\sigma_{d2}, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$\sigma_3, -i\sigma_2;$	
$T';$	MK;	$\sigma_{d1}, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	
$S';$	LH;	$\sigma_{d1}, I\mathcal{T};$	$\{R_2, R_4\};$	2;	$\sigma_3, -i\sigma_2;$	
$\Sigma;$	$\Gamma M;$	$C_{21}', I\mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	
$R;$	AL;	$C_{21}', E, I\mathcal{T};$	$\{R_5, R_5\};$	2;	$-i\sigma_0, \sigma_0, -i\sigma_2;$	
			$\{R_7, R_7\};$	2;	$i\sigma_0, \sigma_0, -i\sigma_2;$	



$\Gamma_h$ ;  $\{C_3^+|000\}, \{C_{21}''|000\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_3^+, C_{21}'', I, \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2;	$-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2$ ;
		$R_6$ ;	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, \sigma_0, -i\sigma_2$ ;
		$\{R_9, R_{10}\}$ ;	2;	$-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2$ ;
		$R_{12}$ ;	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -\sigma_0, -i\sigma_2$ ;
$M$ ; $(0\frac{1}{2}0)$ ;	$C_{21}'', I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, \sigma_0, -i\sigma_2$ ;
		$\{R_6, R_8\}$ ;	2;	$i\sigma_3, -\sigma_0, -i\sigma_2$ ;
$A$ ; $(00\frac{1}{2})$ ;	$C_3^+, C_{21}'', I, \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2;	$-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2$ ;
		$R_6$ ;	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, \sigma_0, -i\sigma_2$ ;
		$\{R_9, R_{10}\}$ ;	2;	$-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2$ ;
		$R_{12}$ ;	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -\sigma_0, -i\sigma_2$ ;
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ;	$C_{21}'', I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, \sigma_0, -i\sigma_2$ ;
		$\{R_6, R_8\}$ ;	2;	$i\sigma_3, -\sigma_0, -i\sigma_2$ ;
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ;	$C_3^+, C_{21}'', I, \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2;	$-\sigma_0, i\sigma_3, -i\sigma_2$ ;
		$R_6$ ;	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2$ ;
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ;	$C_3^+, C_{21}'', I, \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2;	$-\sigma_0, i\sigma_3, -i\sigma_2$ ;
		$R_6$ ;	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2$ ;
$\Delta$ ; $\Gamma A$ ;	$C_3^+, \sigma_{v1}, I, \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2;	$-\sigma_0, i\sigma_3, -i\sigma_2$ ;
		$R_6$ ;	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2$ ;
$U$ ; ML;	$\sigma_{v1}, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;
$P$ ; KH;	$C_3^+, I, \mathcal{T}$ ;	$\{R_2, R_6\}$ ;	2;	$\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2$ ;
		$\{R_4, R_4\}$ ;	2;	$-\sigma_0, -i\sigma_2$ ;
$T$ ; $\Gamma K$ ;	$C_{22}'', I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;
$S$ ; AH;	$C_{22}'', I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;
$T'$ ; MK;	$C_{21}'', I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;
$S'$ ; LH;	$C_{21}'', I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;
$\Sigma$ ; $\Gamma M$ ;	$\sigma_{v1}, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;
$R$ ; AL;	$\sigma_{v1}, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2;	$i\sigma_3, -i\sigma_2$ ;

$\Gamma_h; \{C_3^+|000\}, \{C_{21}''|00\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C_{21}'', I, \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$	
			$R_6;$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, \sigma_0, -i\sigma_2;$	
			$\{R_9, R_{10}\};$	2;	$-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$	
			$R_{12};$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -\sigma_0, -i\sigma_2;$	
$M;$	$(0\frac{1}{2}0);$	$C_{21}'', I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, \sigma_0, -i\sigma_2;$	
			$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_0, -i\sigma_2;$	
$A;$	$(00\frac{1}{2});$	$\bar{C}_3^+, C_{21}'', I, \mathcal{T};$	$\{R_{10}, R_{10}\};$	4;	$-\Gamma_{0,0}, i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	CDP; 0
			$\{R_{17}, R_{18}\};$	4;	$\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, i\Gamma_{3,1}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$L;$	$(0\frac{1}{2}\frac{1}{2});$	$C_{21}'', E, I, \mathcal{T};$	$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP; 0
$K;$	$(\frac{1}{3}\frac{2}{3}0);$	$C_3^+, C_{21}', I, \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
$H;$	$(\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, C_{21}'', I, \mathcal{T};$	$\{R_3, R_3\};$	2;	$-\sigma_0, i\sigma_0, -i\sigma_2;$	
			$\{R_4, R_4\};$	2;	$-\sigma_0, -i\sigma_0, -i\sigma_2;$	
			$\{R_6, R_6\};$	4;	$\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2}}{2}, i\Gamma_{0,3}, i\Gamma_{2,0};$	DP; 0
$\Delta;$	$\Gamma A;$	$C_{3,\sigma v1}^+, I, \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
$U;$	$ML;$	$\sigma_{v1}, I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	
$P;$	$KH;$	$C_3^+, I, \mathcal{T};$	$\{R_2, R_6\};$	2;	$\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$	
			$\{R_4, R_4\};$	2;	$-\sigma_0, -i\sigma_2;$	
$T;$	$\Gamma K;$	$C_{22}'', I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	
$S;$	$AH;$	$C_{22}'', E, I, \mathcal{T};$	$\{R_5, R_5\};$	2;	$-i\sigma_0, \sigma_0, -i\sigma_2;$	
			$\{R_7, R_7\};$	2;	$i\sigma_0, \sigma_0, -i\sigma_2;$	
$T';$	$MK;$	$C_{21}'', I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	
$S';$	$LH;$	$C_{21}'', E, I, \mathcal{T};$	$\{R_5, R_5\};$	2;	$-i\sigma_0, \sigma_0, -i\sigma_2;$	
			$\{R_7, R_7\};$	2;	$i\sigma_0, \sigma_0, -i\sigma_2;$	
$\Sigma;$	$\Gamma M;$	$\sigma_{v1}, I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	
$R;$	$AL;$	$\sigma_{v1}, I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$\sigma_3, -i\sigma_2;$	

$\Gamma_{rh}; \{C_3^+|000\}, \{C'_{21}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C'_{21}, I, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$
			$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_9, R_{10}\};$	$2; -\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$
			$R_{12};$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -\sigma_0, -i\sigma_2;$
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_3^+, C'_{21}, I, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$
			$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_9, R_{10}\};$	$2; -\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$
			$R_{12};$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -\sigma_0, -i\sigma_2;$
$L;$	$(0\frac{1}{2}0);$	$C'_{22}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$C'_{21}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$C'_{23}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_0, -i\sigma_2;$
			$\{R_6, R_8\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, \sigma_{d1}, I, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$
			$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$
$P;$	$ZP;$	$C_3^+, \sigma_{d1}, I, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$
			$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$
$B;$	$ZB;$	$C'_{21}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$C'_{21}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$
$Q;$	$FQ;$	$C'_{23}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$
$Y;$	$LZ/LY;$	$C'_{22}, I, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$

$\Gamma_{rh}; \{C_3^+|000\}, \{C'_{21}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma;$	$(000);$	$C_3^+, C'_{21}, I, \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2;$	
			$R_6;$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, \sigma_0, -i\sigma_2;$	
			$\{R_9, R_{10}\};$	2;	$-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2;$	
			$R_{12};$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -\sigma_0, -i\sigma_2;$	
$Z;$	$(\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$\bar{C}_3^+, C'_{21}, I, \mathcal{T};$	$\{R_{10}, R_{10}\};$	4;	$-\Gamma_{0,0}, i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	CDP; 0
			$\{R_{17}, R_{18}\};$	4;	$\frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}}{2}, i\Gamma_{3,1}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$L;$	$(0\frac{1}{2}0);$	$C'_{22}, E, I, \mathcal{T};$	$\{R_{10}, R_{10}\};$	4;	$i\Gamma_{0,2}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP; 0
$(a)F;$	$(0\frac{1}{2}\frac{1}{2});$	$C'_{21}, I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, \sigma_0, -i\sigma_2;$	
			$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_0, -i\sigma_2;$	
$(b)F;$	$(\frac{1}{2}\frac{1}{2}0);$	$C'_{23}, I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, \sigma_0, -i\sigma_2;$	
			$\{R_6, R_8\};$	2;	$i\sigma_3, -\sigma_0, -i\sigma_2;$	
$\Lambda;$	$\Gamma\Lambda/\Gamma Z;$	$C_3^+, \sigma_{d1}, I, \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
$P;$	$ZP;$	$C_3^+, \sigma_{d1}, I, \mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, \sigma_3, -i\sigma_2;$	
			$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), \sigma_3, -i\sigma_2;$	
$B;$	$ZB;$	$C'_{21}, E, I, \mathcal{T};$	$\{R_5, R_5\};$	2;	$i\sigma_0, \sigma_0, -i\sigma_2;$	
			$\{R_7, R_7\};$	2;	$-i\sigma_0, \sigma_0, -i\sigma_2;$	
$\Sigma;$	$\Gamma F/\Gamma\Sigma;$	$C'_{21}, I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$i\sigma_3, -i\sigma_2;$	
$Q;$	$FQ;$	$C'_{23}, I, \mathcal{T};$	$\{R_2, R_4\};$	2;	$-i\sigma_3, -i\sigma_2;$	
$Y;$	$LZ/LY;$	$C'_{22}, E, I, \mathcal{T};$	$\{R_5, R_5\};$	2;	$-i\sigma_0, \sigma_0, -i\sigma_2;$	
			$\{R_7, R_7\};$	2;	$i\sigma_0, \sigma_0, -i\sigma_2;$	

$\Gamma$ ; (000); $C_6^+, \mathcal{T}$ ;	$\{R_2, R_{12}\}; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
	$\{R_4, R_{10}\}; 2; i\sigma_3, -i\sigma_2;$	C-3 WP; 3
	$\{R_6, R_8\}; 2; \frac{\sqrt{3}\sigma_0-i\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
$M$ ; $(0\frac{1}{2}0)$ ; $C_2, \mathcal{T}$ ;	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$A$ ; $(00\frac{1}{2})$ ; $C_6^+, \mathcal{T}$ ;	$\{R_2, R_{12}\}; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
	$\{R_4, R_{10}\}; 2; i\sigma_3, -i\sigma_2;$	C-3 WP; 3
	$\{R_6, R_8\}; 2; \frac{\sqrt{3}\sigma_0-i\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_2, \mathcal{T}$ ;	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+, C_6^+ \mathcal{T}$ ;	$\{R_2, R_6\}; 2; \frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \frac{e^{-\frac{i\pi}{3}}(\sigma_1+\sqrt{3}\sigma_2)}{2};$	C-1 WP; 1
	$R_4; 1; -1, 1;$	
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^+, C_6^+ \mathcal{T}$ ;	$\{R_2, R_6\}; 2; \frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \frac{e^{-\frac{i\pi}{3}}(\sigma_1+\sqrt{3}\sigma_2)}{2};$	C-1 WP; 1
	$R_4; 1; -1, 1;$	
$\Delta$ ; $\Gamma A$ ; $C_6^+$ ;	$R_2; 1; \sqrt[6]{-1};$	
	$R_4; 1; i;$	
	$R_6; 1; (-1)^{5/6};$	
	$R_8; 1; -\sqrt[6]{-1};$	
	$R_{10}; 1; -i;$	
	$R_{12}; 1; -(-1)^{5/6};$	
$U$ ; ML; $C_2$ ;	$R_2; 1; i;$	
	$R_4; 1; -i;$	
$P$ ; KH; $C_3^+$ ;	$R_2; 1; \sqrt[3]{-1};$	
	$R_4; 1; -1;$	
	$R_6; 1; -(-1)^{2/3};$	
$T$ ; $\Gamma K$ ; $\bar{E}, C_2 \mathcal{T}$ ;	$R_2; 1; -1, 1;$	
$S$ ; AH; $\bar{E}, C_2 \mathcal{T}$ ;	$R_2; 1; -1, 1;$	
$T'$ ; MK; $\bar{E}, C_2 \mathcal{T}$ ;	$R_2; 1; -1, 1;$	
$S'$ ; LH; $\bar{E}, C_2 \mathcal{T}$ ;	$R_2; 1; -1, 1;$	
$\Sigma$ ; $\Gamma M$ ; $\bar{E}, C_2 \mathcal{T}$ ;	$R_2; 1; -1, 1;$	
$R$ ; AL; $\bar{E}, C_2 \mathcal{T}$ ;	$R_2; 1; -1, 1;$	

$\Gamma_h$ ;  $\{C_6^+|00\frac{1}{6}\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_6^+, \mathcal{T}$ ;	$\{R_2, R_{12}\}; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
		$\{R_4, R_{10}\}; 2; i\sigma_3, -i\sigma_2;$	C-3 WP; 3
		$\{R_6, R_8\}; 2; \frac{\sqrt{3}\sigma_0-i\sigma_3}{-2}, -i\sigma_2;$	C-1 WP; 1
$M$ ; $(0\frac{1}{2}0)$ ;	$C_2, \mathcal{T}$ ;	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$A$ ; $(00\frac{1}{2})$ ;	$C_6^+, \mathcal{T}$ ;	$\{R_1, R_1\}; 2; \sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
		$\{R_3, R_{11}\}; 2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$	P-NS <sub>ALH</sub> ;
		$\{R_5, R_9\}; 2; \frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$	P-NS <sub>ALH</sub> ;
		$\{R_7, R_7\}; 2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ;	$C_2, \mathcal{T}$ ;	$\{R_1, R_1\}; 2; \sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
		$\{R_3, R_3\}; 2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ;	$C_3^+, C_6^+ \mathcal{T}$ ;	$\{R_2, R_6\}; 2; \frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \frac{e^{-\frac{i\pi}{3}}(\sigma_1+\sqrt{3}\sigma_2)}{2};$	C-1 WP; 1
		$R_4; 1; -1, 1;$	
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ;	$C_3^-, C_6^+ \mathcal{T}$ ;	$\{R_2, R_6\}; 2; \frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \frac{e^{-\frac{i\pi}{6}}(\sqrt{3}\sigma_1+\sigma_2)}{2};$	P-NS <sub>ALH</sub> ;
		$\{R_4, R_4\}; 2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
$\Delta$ ; $\Gamma A$ ;	$C_6^+$ ;	$R_2; 1; \sqrt[6]{-1};$	
		$R_4; 1; i;$	
		$R_6; 1; (-1)^{5/6};$	
		$R_8; 1; -\sqrt[6]{-1};$	
		$R_{10}; 1; -i;$	
		$R_{12}; 1; -(-1)^{5/6};$	
$U$ ; ML;	$C_2$ ;	$R_2; 1; i;$	
		$R_4; 1; -i;$	
$P$ ; KH;	$C_3^+$ ;	$R_2; 1; \sqrt[3]{-1};$	
		$R_4; 1; -1;$	
		$R_6; 1; -(-1)^{2/3};$	
$T$ ; $\Gamma K$ ;	$\bar{E}, C_2 \mathcal{T}$ ;	$R_2; 1; -1, 1;$	
$S$ ; AH;	$\bar{E}, C_2 \mathcal{T}$ ;	$\{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$T'$ ; MK;	$\bar{E}, C_2 \mathcal{T}$ ;	$R_2; 1; -1, 1;$	
$S'$ ; LH;	$\bar{E}, C_2 \mathcal{T}$ ;	$\{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$\Sigma$ ; $\Gamma M$ ;	$\bar{E}, C_2 \mathcal{T}$ ;	$R_2; 1; -1, 1;$	
$R$ ; AL;	$\bar{E}, C_2 \mathcal{T}$ ;	$\{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;

$\Gamma_h$ ;  $\{C_6^+|00\frac{5}{6}\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; $(000)$ ; $C_6^+, \mathcal{T}$ ;	$\{R_2, R_{12}\}$ ; 2;	$\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, -i\sigma_2$ ;	C-1 WP; 1
	$\{R_4, R_{10}\}$ ; 2;	$i\sigma_3, -i\sigma_2$ ;	C-3 WP; 3
	$\{R_6, R_8\}$ ; 2;	$\frac{\sqrt{3}\sigma_0-i\sigma_3}{-2}, -i\sigma_2$ ;	C-1 WP; 1
$M$ ; $(0\frac{1}{2}0)$ ; $C_2, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2;	$i\sigma_3, -i\sigma_2$ ;	C-1 WP; 1
$A$ ; $(00\frac{1}{2})$ ; $C_6^+, \mathcal{T}$ ;	$\{R_1, R_1\}$ ; 2;	$\sigma_0, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$\{R_3, R_{11}\}$ ; 2;	$\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$\{R_5, R_9\}$ ; 2;	$\frac{\sigma_0-i\sqrt{3}\sigma_3}{-2}, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$\{R_7, R_7\}$ ; 2;	$-\sigma_0, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_2, \mathcal{T}$ ;	$\{R_1, R_1\}$ ; 2;	$\sigma_0, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$\{R_3, R_3\}$ ; 2;	$-\sigma_0, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+, C_6^+, \mathcal{T}$ ;	$\{R_2, R_6\}$ ; 2;	$\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \frac{e^{-\frac{i\pi}{3}}(\sigma_1+\sqrt{3}\sigma_2)}{2}$ ;	C-1 WP; 1
	$R_4$ ; 1;	$-1, 1$ ;	
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^+, C_6^+, \mathcal{T}$ ;	$\{R_2, R_6\}$ ; 2;	$\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \frac{e^{\frac{i\pi}{6}}(\sqrt{3}\sigma_1-\sigma_2)}{2}$ ;	P-NS <sub>ALH</sub> ;
	$\{R_4, R_4\}$ ; 2;	$-\sigma_0, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
$\Delta$ ; $\Gamma A$ ; $C_6^+$ ;	$R_2$ ; 1;	$\sqrt[6]{-1}$ ;	
	$R_4$ ; 1;	$i$ ;	
	$R_6$ ; 1;	$(-1)^{5/6}$ ;	
	$R_8$ ; 1;	$-\sqrt[6]{-1}$ ;	
	$R_{10}$ ; 1;	$-i$ ;	
	$R_{12}$ ; 1;	$-(-1)^{5/6}$ ;	
$U$ ; ML; $C_2$ ;	$R_2$ ; 1;	$i$ ;	
	$R_4$ ; 1;	$-i$ ;	
$P$ ; KH; $C_3^+$ ;	$R_2$ ; 1;	$\sqrt[3]{-1}$ ;	
	$R_4$ ; 1;	$-1$ ;	
	$R_6$ ; 1;	$-(-1)^{2/3}$ ;	
$T$ ; $\Gamma K$ ; $\bar{E}, C_2 \mathcal{T}$ ;	$R_2$ ; 1;	$-1, 1$ ;	
$S$ ; AH; $\bar{E}, C_2 \mathcal{T}$ ;	$\{R_2, R_2\}$ ; 2;	$-\sigma_0, -i\sigma_2$ ;	L-NS <sub>ALH</sub> ;
$T'$ ; MK; $\bar{E}, C_2 \mathcal{T}$ ;	$R_2$ ; 1;	$-1, 1$ ;	
$S'$ ; LH; $\bar{E}, C_2 \mathcal{T}$ ;	$\{R_2, R_2\}$ ; 2;	$-\sigma_0, -i\sigma_2$ ;	L-NS <sub>ALH</sub> ;
$\Sigma$ ; $\Gamma M$ ; $\bar{E}, C_2 \mathcal{T}$ ;	$R_2$ ; 1;	$-1, 1$ ;	
$R$ ; AL; $\bar{E}, C_2 \mathcal{T}$ ;	$\{R_2, R_2\}$ ; 2;	$-\sigma_0, -i\sigma_2$ ;	L-NS <sub>ALH</sub> ;

SG 171

 $\Gamma_h; \{C_6^+ | 00\frac{1}{3}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_6^+, \mathcal{T};$	$\{R_2, R_{12}\}; 2; \frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
		$\{R_4, R_{10}\}; 2; i\sigma_3, -i\sigma_2;$	C-3 WP; 3
		$\{R_6, R_8\}; 2; \frac{\sqrt{3}\sigma_0 - i\sigma_3}{-2}, -i\sigma_2;$	C-1 WP; 1
$M$ ; $(0\frac{1}{2}0)$ ;	$C_2, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$A$ ; $(00\frac{1}{2})$ ;	$C_6^+, \mathcal{T};$	$\{R_2, R_{12}\}; 2; \frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
		$\{R_4, R_{10}\}; 2; i\sigma_3, -i\sigma_2;$	C-3 WP; 3
		$\{R_6, R_8\}; 2; \frac{\sqrt{3}\sigma_0 - i\sigma_3}{-2}, -i\sigma_2;$	C-1 WP; 1
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ;	$C_2, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ;	$C_3^+, C_6^+ \mathcal{T};$	$\{R_2, R_6\}; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \frac{e^{-\frac{i\pi}{3}}(\sigma_1 + \sqrt{3}\sigma_2)}{2};$	C-1 WP; 1
		$R_4; 1; -1, 1;$	
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ;	$C_3^+, C_6^+ \mathcal{T};$	$\{R_2, R_6\}; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \frac{e^{-\frac{i\pi}{3}}(\sigma_1 + \sqrt{3}\sigma_2)}{2};$	C-1 WP; 1
		$R_4; 1; -1, 1;$	
$\Delta$ ; $\Gamma A$ ;	$C_6^+;$	$R_2; 1; \sqrt[6]{-1};$	
		$R_4; 1; i;$	
		$R_6; 1; (-1)^{5/6};$	
		$R_8; 1; -\sqrt[6]{-1};$	
		$R_{10}; 1; -i;$	
		$R_{12}; 1; -(-1)^{5/6};$	
$U$ ; ML;	$C_2;$	$R_2; 1; i;$	
		$R_4; 1; -i;$	
$P$ ; KH;	$C_3^+;$	$R_2; 1; \sqrt[3]{-1};$	
		$R_4; 1; -1;$	
		$R_6; 1; -(-1)^{2/3};$	
$T$ ; $\Gamma K$ ;	$\bar{E}, C_2 \mathcal{T};$	$R_2; 1; -1, 1;$	
$S$ ; AH;	$\bar{E}, C_2 \mathcal{T};$	$R_2; 1; -1, 1;$	
$T'$ ; MK;	$\bar{E}, C_2 \mathcal{T};$	$R_2; 1; -1, 1;$	
$S'$ ; LH;	$\bar{E}, C_2 \mathcal{T};$	$R_2; 1; -1, 1;$	
$\Sigma$ ; $\Gamma M$ ;	$\bar{E}, C_2 \mathcal{T};$	$R_2; 1; -1, 1;$	
$R$ ; AL;	$\bar{E}, C_2 \mathcal{T};$	$R_2; 1; -1, 1;$	



$\Gamma_h; \{C_6^+ | 00\frac{2}{3}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$ (000);	$C_6^+, \mathcal{T};$	$\{R_2, R_{12}\};$	$2; \frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
		$\{R_4, R_{10}\};$	$2; i\sigma_3, -i\sigma_2;$	C-3 WP; 3
		$\{R_6, R_8\};$	$2; \frac{\sqrt{3}\sigma_0 - i\sigma_3}{-2}, -i\sigma_2;$	C-1 WP; 1
$M;$ ( $0\frac{1}{2}0$ );	$C_2, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$A;$ ( $00\frac{1}{2}$ );	$C_6^+, \mathcal{T};$	$\{R_2, R_{12}\};$	$2; \frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
		$\{R_4, R_{10}\};$	$2; i\sigma_3, -i\sigma_2;$	C-3 WP; 3
		$\{R_6, R_8\};$	$2; \frac{\sqrt{3}\sigma_0 - i\sigma_3}{-2}, -i\sigma_2;$	C-1 WP; 1
$L;$ ( $0\frac{1}{2}\frac{1}{2}$ );	$C_2, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$K;$ ( $\frac{1}{3}\frac{2}{3}0$ );	$C_3^+, C_6^+ \mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \frac{e^{-\frac{i\pi}{3}}(\sigma_1 + \sqrt{3}\sigma_2)}{2};$	C-1 WP; 1
		$R_4;$	$1; -1, 1;$	
$H;$ ( $\frac{1}{3}\frac{2}{3}\frac{1}{2}$ );	$C_3^-, C_6^+ \mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \frac{e^{\frac{i\pi}{3}}(\sigma_1 - \sqrt{3}\sigma_2)}{2};$	C-1 WP; 1
		$R_4;$	$1; -1, 1;$	
$\Delta;$ $\Gamma A;$	$C_6^+;$	$R_2;$	$1; \sqrt[6]{-1};$	
		$R_4;$	$1; i;$	
		$R_6;$	$1; (-1)^{5/6};$	
		$R_8;$	$1; -\sqrt[6]{-1};$	
		$R_{10};$	$1; -i;$	
		$R_{12};$	$1; -(-1)^{5/6};$	
$U;$ ML;	$C_2;$	$R_2;$	$1; i;$	
		$R_4;$	$1; -i;$	
$P;$ KH;	$C_3^+;$	$R_2;$	$1; \sqrt[3]{-1};$	
		$R_4;$	$1; -1;$	
		$R_6;$	$1; -(-1)^{2/3};$	
$T;$ $\Gamma K;$	$\bar{E}, C_2 \mathcal{T};$	$R_2;$	$1; -1, 1;$	
$S;$ AH;	$\bar{E}, C_2 \mathcal{T};$	$R_2;$	$1; -1, 1;$	
$T';$ MK;	$\bar{E}, C_2 \mathcal{T};$	$R_2;$	$1; -1, 1;$	
$S';$ LH;	$\bar{E}, C_2 \mathcal{T};$	$R_2;$	$1; -1, 1;$	
$\Sigma;$ $\Gamma M;$	$\bar{E}, C_2 \mathcal{T};$	$R_2;$	$1; -1, 1;$	
$R;$ AL;	$\bar{E}, C_2 \mathcal{T};$	$R_2;$	$1; -1, 1;$	

$\Gamma_h; \{C_6^+ | 00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma;$ (000);	$C_6^+, \mathcal{T};$	$\{R_2, R_{12}\};$	$2; \frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, -i\sigma_2;$	C-1 WP;	1
		$\{R_4, R_{10}\};$	$2; i\sigma_3, -i\sigma_2;$	C-3 WP;	3
		$\{R_6, R_8\};$	$2; \frac{\sqrt{3}\sigma_0 - i\sigma_3}{-2}, -i\sigma_2;$	C-1 WP;	1
$M;$ ( $0\frac{1}{2}0$ );	$C_2, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP;	1
$A;$ ( $00\frac{1}{2}$ );	$C_6^+, \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;	
		$\{R_3, R_{11}\};$	$2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$	P-NS <sub>ALH</sub> ;	
		$\{R_5, R_9\};$	$2; \frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$	P-NS <sub>ALH</sub> ;	
		$\{R_7, R_7\};$	$2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;	
$L;$ ( $0\frac{1}{2}\frac{1}{2}$ );	$C_2, \mathcal{T};$	$\{R_1, R_1\};$	$2; \sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;	
		$\{R_3, R_3\};$	$2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;	
$K;$ ( $\frac{1}{3}\frac{2}{3}0$ );	$C_3^+, C_6^+ \mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \frac{e^{-\frac{i\pi}{3}}(\sigma_1 + \sqrt{3}\sigma_2)}{2};$	C-1 WP;	1
		$R_4;$	$1; -1, 1;$		
$H;$ ( $\frac{1}{3}\frac{2}{3}\frac{1}{2}$ );	$C_3^+, C_6^+ \mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \frac{e^{\frac{i\pi}{6}}(\sqrt{3}\sigma_1 - \sigma_2)}{2};$	P-NS <sub>ALH</sub> ;	
		$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$	P-NS <sub>ALH</sub> ;	
$\Delta;$ $\Gamma A;$	$C_6^+;$	$R_2;$	$1; \sqrt[6]{-1};$		
		$R_4;$	$1; i;$		
		$R_6;$	$1; (-1)^{5/6};$		
		$R_8;$	$1; -\sqrt[6]{-1};$		
		$R_{10};$	$1; -i;$		
		$R_{12};$	$1; -(-1)^{5/6};$		
$U;$ ML;	$C_2;$	$R_2;$	$1; i;$		
		$R_4;$	$1; -i;$		
$P;$ KH;	$C_3^+;$	$R_2;$	$1; \sqrt[3]{-1};$		
		$R_4;$	$1; -1;$		
		$R_6;$	$1; -(-1)^{2/3};$		
$T;$ $\Gamma K;$	$\bar{E}, C_2 \mathcal{T};$	$R_2;$	$1; -1, 1;$		
$S;$ AH;	$\bar{E}, C_2 \mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;	
$T';$ MK;	$\bar{E}, C_2 \mathcal{T};$	$R_2;$	$1; -1, 1;$		
$S';$ LH;	$\bar{E}, C_2 \mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;	
$\Sigma;$ $\Gamma M;$	$\bar{E}, C_2 \mathcal{T};$	$R_2;$	$1; -1, 1;$		
$R;$ AL;	$\bar{E}, C_2 \mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;	

$\Gamma$ ; (000); $S_3^+, \mathcal{T}$ ;	$\{R_2, R_{12}\}$ ; 2;	$\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, -i\sigma_2$ ;	P-WNLs;
	$\{R_4, R_{10}\}$ ; 2;	$i\sigma_3, -i\sigma_2$ ;	P-WNLs;
	$\{R_6, R_8\}$ ; 2;	$\frac{\sqrt{3}\sigma_0-i\sigma_3}{-2}, -i\sigma_2$ ;	P-WNLs;
$M$ ; $(0\frac{1}{2}0)$ ; $\sigma_h, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$A$ ; $(00\frac{1}{2})$ ; $S_3^+, \mathcal{T}$ ;	$\{R_2, R_{12}\}$ ; 2;	$\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, -i\sigma_2$ ;	P-WNLs;
	$\{R_4, R_{10}\}$ ; 2;	$i\sigma_3, -i\sigma_2$ ;	P-WNLs;
	$\{R_6, R_8\}$ ; 2;	$\frac{\sqrt{3}\sigma_0-i\sigma_3}{-2}, -i\sigma_2$ ;	P-WNLs;
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $\sigma_h, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2;	$i\sigma_3, -i\sigma_2$ ;	P-WNL;
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $S_3^+$ ;	$R_2$ ;	1; $\sqrt[6]{-1}$ ;	
	$R_4$ ;	1; $i$ ;	
	$R_6$ ;	1; $(-1)^{5/6}$ ;	
	$R_8$ ;	1; $-\sqrt[6]{-1}$ ;	
	$R_{10}$ ;	1; $-i$ ;	
	$R_{12}$ ;	1; $-(-1)^{5/6}$ ;	
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $S_3^+$ ;	$R_2$ ;	1; $\sqrt[6]{-1}$ ;	
	$R_4$ ;	1; $i$ ;	
	$R_6$ ;	1; $(-1)^{5/6}$ ;	
	$R_8$ ;	1; $-\sqrt[6]{-1}$ ;	
	$R_{10}$ ;	1; $-i$ ;	
	$R_{12}$ ;	1; $-(-1)^{5/6}$ ;	
$\Delta$ ; $\Gamma A$ ;	$C_3^+, S_3^+ \mathcal{T}$ ; $\{R_2, R_6\}$ ; 2;	$\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \frac{e^{i\pi/3}(\sigma_1-\sqrt{3}\sigma_2)}{2}$ ;	QNL; 0
	$R_4$ ;	1; $-1, 1$ ;	
$U$ ; ML;	$\bar{E}, \mathcal{T}\sigma_h$ ;	$R_2$ ;	1; $-1, 1$ ;
$P$ ; KH;	$C_3^+$ ;	$R_2$ ;	1; $\sqrt[3]{-1}$ ;
	$R_4$ ;	1; $-1$ ;	
	$R_6$ ;	1; $-(-1)^{2/3}$ ;	
$T$ ; $\Gamma K$ ;	$\sigma_h$ ;	$R_2$ ;	1; $i$ ;
	$R_4$ ;	1; $-i$ ;	
$S$ ; AH;	$\sigma_h$ ;	$R_2$ ;	1; $i$ ;
	$R_4$ ;	1; $-i$ ;	
$T'$ ; MK;	$\sigma_h$ ;	$R_2$ ;	1; $i$ ;
	$R_4$ ;	1; $-i$ ;	
$S'$ ; LH;	$\sigma_h$ ;	$R_2$ ;	1; $i$ ;
	$R_4$ ;	1; $-i$ ;	
$\Sigma$ ; $\Gamma M$ ;	$\sigma_h$ ;	$R_2$ ;	1; $i$ ;
	$R_4$ ;	1; $-i$ ;	
$R$ ; AL;	$\sigma_h$ ;	$R_2$ ;	1; $i$ ;
	$R_4$ ;	1; $-i$ ;	

$\Gamma_h$ ;  $\{C_6^+|000\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; $(000)$ ; $C_6^+, I, \mathcal{T}$ ; $\{R_2, R_{12}\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), \sigma_0, -i\sigma_2$ ; $\{R_4, R_{10}\}$ ; 2; $i\sigma_3, \sigma_0, -i\sigma_2$ ; $\{R_6, R_8\}$ ; 2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), \sigma_0, -i\sigma_2$ ; $\{R_{14}, R_{24}\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), -\sigma_0, -i\sigma_2$ ; $\{R_{16}, R_{22}\}$ ; 2; $i\sigma_3, -\sigma_0, -i\sigma_2$ ; $\{R_{18}, R_{20}\}$ ; 2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), -\sigma_0, -i\sigma_2$ ;	
$M$ ; $(0\frac{1}{2}0)$ ; $C_2, I, \mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, \sigma_0, -i\sigma_2$ ; $\{R_6, R_8\}$ ; 2; $i\sigma_3, -\sigma_0, -i\sigma_2$ ;	
$A$ ; $(00\frac{1}{2})$ ; $C_6^+, I, \mathcal{T}$ ; $\{R_2, R_{12}\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), \sigma_0, -i\sigma_2$ ; $\{R_4, R_{10}\}$ ; 2; $i\sigma_3, \sigma_0, -i\sigma_2$ ; $\{R_6, R_8\}$ ; 2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), \sigma_0, -i\sigma_2$ ; $\{R_{14}, R_{24}\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), -\sigma_0, -i\sigma_2$ ; $\{R_{16}, R_{22}\}$ ; 2; $i\sigma_3, -\sigma_0, -i\sigma_2$ ; $\{R_{18}, R_{20}\}$ ; 2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), -\sigma_0, -i\sigma_2$ ;	
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_2, I, \mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, \sigma_0, -i\sigma_2$ ; $\{R_6, R_8\}$ ; 2; $i\sigma_3, -\sigma_0, -i\sigma_2$ ;	
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $S_3^+, I\mathcal{T}$ ; $\{R_2, R_{12}\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), -i\sigma_2$ ; $\{R_4, R_{10}\}$ ; 2; $i\sigma_3, -i\sigma_2$ ; $\{R_6, R_8\}$ ; 2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), -i\sigma_2$ ;	
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $S_3^+, I\mathcal{T}$ ; $\{R_2, R_{12}\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), -i\sigma_2$ ; $\{R_4, R_{10}\}$ ; 2; $i\sigma_3, -i\sigma_2$ ; $\{R_6, R_8\}$ ; 2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), -i\sigma_2$ ;	
$\Delta$ ; $\Gamma A$ ; $C_6^+, I\mathcal{T}$ ; $\{R_2, R_{12}\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), -i\sigma_2$ ; $\{R_4, R_{10}\}$ ; 2; $i\sigma_3, -i\sigma_2$ ; $\{R_6, R_8\}$ ; 2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), -i\sigma_2$ ;	
$U$ ; $ML$ ; $C_2, I\mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$P$ ; $KH$ ; $C_3^+, I\mathcal{T}$ ; $\{R_2, R_6\}$ ; 2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2$ ; $\{R_4, R_4\}$ ; 2; $-\sigma_0, -i\sigma_2$ ;	
$T$ ; $\Gamma K$ ; $\sigma_h, I\mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$S$ ; $AH$ ; $\sigma_h, I\mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$T'$ ; $MK$ ; $\sigma_h, I\mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$S'$ ; $LH$ ; $\sigma_h, I\mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$\Sigma$ ; $\Gamma M$ ; $\sigma_h, I\mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$R$ ; $AL$ ; $\sigma_h, I\mathcal{T}$ ; $\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	

$\Gamma_h$ ;  $\{C_6^+|00\frac{1}{2}\}, \{I|00\frac{1}{2}\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; $(000)$ ; $C_6^+, I, \mathcal{T}$ ;	$\{R_2, R_{12}\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), \sigma_0, -i\sigma_2$ ;	
	$\{R_4, R_{10}\}$ ; 2; $i\sigma_3, \sigma_0, -i\sigma_2$ ;	
	$\{R_6, R_8\}$ ; 2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), \sigma_0, -i\sigma_2$ ;	
	$\{R_{14}, R_{24}\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), -\sigma_0, -i\sigma_2$ ;	
	$\{R_{16}, R_{22}\}$ ; 2; $i\sigma_3, -\sigma_0, -i\sigma_2$ ;	
	$\{R_{18}, R_{20}\}$ ; 2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), -\sigma_0, -i\sigma_2$ ;	
$M$ ; $(0\frac{1}{2}0)$ ; $C_2, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, \sigma_0, -i\sigma_2$ ;	
	$\{R_6, R_8\}$ ; 2; $i\sigma_3, -\sigma_0, -i\sigma_2$ ;	
$A$ ; $(00\frac{1}{2})$ ; $C_6^+, I, \bar{E}, \mathcal{T}$ ;	$\{R_{28}, R_{30}\}$ ; 4; $\frac{\Gamma_{0,3} - i\sqrt{3}\Gamma_{3,3}}{-2}, \Gamma_{0,1}, -\Gamma_{0,0}, -i\Gamma_{2,0}$ ; P-DNLs;	
	$\{R_{29}, R_{29}\}$ ; 4; $-\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{0,0}, i\Gamma_{2,0}$ ; P-DNLs;	
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $\sigma_h, E, I, \mathcal{T}$ ;	$\{R_{10}, R_{10}\}$ ; 4; $i\Gamma_{0,2}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0}$ ; P-DNL;	
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $S_3^+, I\mathcal{T}$ ;	$\{R_2, R_{12}\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), -i\sigma_2$ ;	
	$\{R_4, R_{10}\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
	$\{R_6, R_8\}$ ; 2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), -i\sigma_2$ ;	
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $S_3^+, I\mathcal{T}$ ;	$\{R_2, R_6\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_3 + i\sigma_0), -i\sigma_2$ ;	
	$\{R_4, R_4\}$ ; 2; $i\sigma_0, -i\sigma_2$ ;	
	$\{R_8, R_{12}\}$ ; 2; $-\frac{1}{2}i(\sigma_0 - i\sqrt{3}\sigma_3), -i\sigma_2$ ;	
	$\{R_{10}, R_{10}\}$ ; 2; $-i\sigma_0, -i\sigma_2$ ;	
$\Delta$ ; $\Gamma A$ ; $C_6^+, I\mathcal{T}$ ;	$\{R_2, R_{12}\}$ ; 2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), -i\sigma_2$ ;	
	$\{R_4, R_{10}\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
	$\{R_6, R_8\}$ ; 2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), -i\sigma_2$ ;	
$U$ ; $ML$ ; $C_2, I\mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$P$ ; $KH$ ; $C_3^+, I\mathcal{T}$ ;	$\{R_2, R_6\}$ ; 2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2$ ;	
	$\{R_4, R_4\}$ ; 2; $-\sigma_0, -i\sigma_2$ ;	
$T$ ; $\Gamma K$ ; $\sigma_h, I\mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$S$ ; $AH$ ; $\sigma_h, I\mathcal{T}$ ;	$\{R_2, R_2\}$ ; 2; $i\sigma_0, -i\sigma_2$ ;	
	$\{R_4, R_4\}$ ; 2; $-i\sigma_0, -i\sigma_2$ ;	
$T'$ ; $MK$ ; $\sigma_h, I\mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$S'$ ; $LH$ ; $\sigma_h, I\mathcal{T}$ ;	$\{R_2, R_2\}$ ; 2; $i\sigma_0, -i\sigma_2$ ;	
	$\{R_4, R_4\}$ ; 2; $-i\sigma_0, -i\sigma_2$ ;	
$\Sigma$ ; $\Gamma M$ ; $\sigma_h, I\mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$R$ ; $AL$ ; $\sigma_h, I\mathcal{T}$ ;	$\{R_2, R_2\}$ ; 2; $i\sigma_0, -i\sigma_2$ ;	
	$\{R_4, R_4\}$ ; 2; $-i\sigma_0, -i\sigma_2$ ;	

$\Gamma_h; \{C_6^+|000\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); C_6^+, C_{21}', \mathcal{T};$	$R_7; 2; i\sigma_3, i\sigma_1, -i\sigma_2;$	C-3 WP; 3
	$R_8; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_9; 2; \frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$M; (0\frac{1}{2}0); C_2, C_{21}'', \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$A; (00\frac{1}{2}); C_6^+, C_{21}', \mathcal{T};$	$R_7; 2; i\sigma_3, i\sigma_1, -i\sigma_2;$	C-3 WP; 3
	$R_8; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_9; 2; \frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$L; (0\frac{1}{2}\frac{1}{2}); C_2, C_{21}'', \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$R_3; 1; -1, i, 1;$	
	$R_4; 1; -1, -i, 1;$	
	$R_6; 2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sigma_0+i\sqrt{3}\sigma_2}{-2};$	C-1 WP; 1
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$R_3; 1; -1, i, 1;$	
	$R_4; 1; -1, -i, 1;$	
	$R_6; 2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sigma_0+i\sqrt{3}\sigma_2}{-2};$	C-1 WP; 1
$\Delta; \Gamma A; C_6^+, C_{23}'', \mathcal{T};$	$R_2; 1; \sqrt[6]{-1}, 1;$	
	$R_4; 1; i, 1;$	
	$R_6; 1; (-1)^{5/6}, 1;$	
	$R_8; 1; -\sqrt[6]{-1}, 1;$	
	$R_{10}; 1; -i, 1;$	
	$R_{12}; 1; -(-1)^{5/6}, 1;$	
$U; ML; C_2, C_{21}'', \mathcal{T};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$P; KH; C_3^+, C_{22}', \mathcal{T};$	$R_2; 1; \sqrt[3]{-1}, 1;$	
	$R_4; 1; -1, 1;$	
	$R_6; 1; -(-1)^{2/3}, 1;$	
$T; \Gamma K; C_{22}'', C_{22}', \mathcal{T};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$S; AH; C_{22}'', C_{22}', \mathcal{T};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$T'; MK; C_{21}'', C_2 \mathcal{T};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$S'; LH; C_{21}'', C_2 \mathcal{T};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$\Sigma; \Gamma M; C_{21}', C_{21}'', \mathcal{T};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$R; AL; C_{21}', C_{21}'', \mathcal{T};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	

$\Gamma_h; \{C_6^+|00\frac{1}{6}\}, \{C_{21}'|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; $(000)$ ; $C_6^+, C_{21}', \mathcal{T}$ ;	$R_7$ ;	2; $i\sigma_3, i\sigma_1, -i\sigma_2$ ;	C-3 WP; 3
	$R_8$ ;	2; $\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
	$R_9$ ;	2; $\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$M$ ; $(0\frac{1}{2}0)$ ; $C_2, C_{21}'', \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$A$ ; $(00\frac{1}{2})$ ; $C_6^+, C_{21}', \mathcal{T}$ ;	$\{R_{10}, R_{11}\}$ ;	2; $\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$\{R_{12}, R_{13}\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$R_{14}$ ;	2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$R_{15}$ ;	2; $\frac{\sigma_0-i\sqrt{3}\sigma_3}{-2}, i\sigma_1, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_2, C_{21}'', \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$\{R_7, R_8\}$ ;	2; $\sigma_0, -i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+, C_{21}'', C_6^+ \mathcal{T}$ ;	$R_3$ ;	1; $-1, i, 1$ ;	
	$R_4$ ;	1; $-1, -i, 1$ ;	
	$R_6$ ;	2; $\frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sigma_0+i\sqrt{3}\sigma_2}{-2}$ ;	C-1 WP; 1
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^-, C_{21}'', C_6^+ \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$R_6$ ;	2; $\frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sqrt{3}\sigma_0+i\sigma_2}{-2}$ ;	P-NS <sub>ALH</sub> ;
$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'', \mathcal{T}$ ;	$R_2$ ;	1; $\sqrt[6]{-1}, 1$ ;	
	$R_4$ ;	1; $i, 1$ ;	
	$R_6$ ;	1; $(-1)^{5/6}, 1$ ;	
	$R_8$ ;	1; $-\sqrt[6]{-1}, 1$ ;	
	$R_{10}$ ;	1; $-i, 1$ ;	
	$R_{12}$ ;	1; $-(-1)^{5/6}, 1$ ;	
$U$ ; ML; $C_2, C_{21}'', \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	
$P$ ; KH; $C_3^+, C_{22}', \mathcal{T}$ ;	$R_2$ ;	1; $\sqrt[3]{-1}, 1$ ;	
	$R_4$ ;	1; $-1, 1$ ;	
	$R_6$ ;	1; $-(-1)^{2/3}, 1$ ;	
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}', \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	
$S$ ; AH; $C_{22}'', \bar{E}, C_{22}' \mathcal{T}$ ;	$\{R_{17}, R_{23}\}$ ;	2; $i\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>ALH</sub> ;
$T'$ ; MK; $C_{21}'', C_2 \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	
$S'$ ; LH; $C_{21}'', \bar{E}, C_2 \mathcal{T}$ ;	$\{R_5, R_7\}$ ;	2; $-i\sigma_3, -\sigma_0, -i\sigma_2$ ;	L-NS <sub>ALH</sub> ;
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'', \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	
$R$ ; AL; $C_{21}', C_{21}'', \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	L-NS <sub>ALH</sub> ;

$\Gamma_h; \{C_6^+|00\frac{5}{6}\}, \{C_{21}'|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; $(000)$ ; $C_6^+, C_{21}', \mathcal{T}$ ;	$R_7$ ;	2; $i\sigma_3, i\sigma_1, -i\sigma_2$ ;	C-3 WP; 3
	$R_8$ ;	2; $\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
	$R_9$ ;	2; $\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$M$ ; $(0\frac{1}{2}0)$ ; $C_2, C_{21}'', \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$A$ ; $(00\frac{1}{2})$ ; $C_6^+, C_{21}', \mathcal{T}$ ;	$\{R_{10}, R_{11}\}$ ;	2; $\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$\{R_{12}, R_{13}\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$R_{14}$ ;	2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$R_{15}$ ;	2; $\frac{\sigma_0-i\sqrt{3}\sigma_3}{-2}, i\sigma_1, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_2, C_{21}'', \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$\{R_7, R_8\}$ ;	2; $\sigma_0, -i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+, C_{21}'', C_6^+, \mathcal{T}$ ;	$R_3$ ;	1; $-1, i, 1$ ;	
	$R_4$ ;	1; $-1, -i, 1$ ;	
	$R_6$ ;	2; $\frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sigma_0+i\sqrt{3}\sigma_2}{-2}$ ;	C-1 WP; 1
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^+, C_{21}'', C_6^+, \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	P-NS <sub>ALH</sub> ;
	$R_6$ ;	2; $\frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sqrt{3}\sigma_0-i\sigma_2}{-2}$ ;	P-NS <sub>ALH</sub> ;
$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'', \mathcal{T}$ ;	$R_2$ ;	1; $\sqrt[6]{-1}, 1$ ;	
	$R_4$ ;	1; $i, 1$ ;	
	$R_6$ ;	1; $(-1)^{5/6}, 1$ ;	
	$R_8$ ;	1; $-\sqrt[6]{-1}, 1$ ;	
	$R_{10}$ ;	1; $-i, 1$ ;	
	$R_{12}$ ;	1; $-(-1)^{5/6}, 1$ ;	
$U$ ; ML; $C_2, C_{21}'', \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	
$P$ ; KH; $C_3^+, C_{22}', \mathcal{T}$ ;	$R_2$ ;	1; $\sqrt[3]{-1}, 1$ ;	
	$R_4$ ;	1; $-1, 1$ ;	
	$R_6$ ;	1; $-(-1)^{2/3}, 1$ ;	
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}', \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	
$S$ ; AH; $C_{22}'', \bar{E}, C_{22}', \mathcal{T}$ ;	$\{R_{15}, R_{21}\}$ ;	2; $-i\sigma_3, -\sigma_0, \sigma_1$ ;	L-NS <sub>ALH</sub> ;
$T'$ ; MK; $C_{21}'', C_2, \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	
$S'$ ; LH; $C_{21}'', \bar{E}, C_2, \mathcal{T}$ ;	$\{R_5, R_7\}$ ;	2; $-i\sigma_3, -\sigma_0, -i\sigma_2$ ;	L-NS <sub>ALH</sub> ;
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'', \mathcal{T}$ ;	$R_2$ ;	1; $i, 1$ ;	
	$R_4$ ;	1; $-i, 1$ ;	
$R$ ; AL; $C_{21}', C_{21}'', \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, \sigma_1$ ;	L-NS <sub>ALH</sub> ;



$\Gamma_h; \{C_6^+|00\frac{1}{3}\}, \{C_{21}'|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; $(000)$ ; $C_6^+, C_{21}', \mathcal{T}$ ;	$R_7$ ; 2; $i\sigma_3, i\sigma_1, -i\sigma_2$ ;	C-3 WP; 3
	$R_8$ ; 2; $\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
	$R_9$ ; 2; $\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$M$ ; $(0\frac{1}{2}0)$ ; $C_2, C_{21}'', \mathcal{T}$ ;	$R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$A$ ; $(00\frac{1}{2})$ ; $C_6^+, C_{21}', \mathcal{T}$ ;	$R_7$ ; 2; $i\sigma_3, i\sigma_1, -i\sigma_2$ ;	C-3 WP; 3
	$R_8$ ; 2; $\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
	$R_9$ ; 2; $\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_2, C_{21}'', \mathcal{T}$ ;	$R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^+, C_{21}'', C_6^+ \mathcal{T}$ ;	$R_3$ ; 1; $-1, i, 1$ ;	
	$R_4$ ; 1; $-1, -i, 1$ ;	
	$R_6$ ; 2; $\frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sigma_0+i\sqrt{3}\sigma_2}{-2}$ ;	C-1 WP; 1
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^+, C_{21}'', C_6^+ \mathcal{T}$ ;	$R_3$ ; 1; $-1, i, 1$ ;	
	$R_4$ ; 1; $-1, -i, 1$ ;	
	$R_6$ ; 2; $\frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sigma_0+i\sqrt{3}\sigma_2}{-2}$ ;	C-1 WP; 1
$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'', \mathcal{T}$ ;	$R_2$ ; 1; $\sqrt[6]{-1}, 1$ ;	
	$R_4$ ; 1; $i, 1$ ;	
	$R_6$ ; 1; $(-1)^{5/6}, 1$ ;	
	$R_8$ ; 1; $-\sqrt[6]{-1}, 1$ ;	
	$R_{10}$ ; 1; $-i, 1$ ;	
	$R_{12}$ ; 1; $-(-1)^{5/6}, 1$ ;	
$U$ ; $ML$ ; $C_2, C_{21}'', \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	
$P$ ; $KH$ ; $C_3^+, C_{22}', \mathcal{T}$ ;	$R_2$ ; 1; $\sqrt[3]{-1}, 1$ ;	
	$R_4$ ; 1; $-1, 1$ ;	
	$R_6$ ; 1; $-(-1)^{2/3}, 1$ ;	
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}', \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	
$S$ ; $AH$ ; $C_{22}'', C_{22}', \mathcal{T}$ ;	$R_6$ ; 1; $i, 1$ ;	
	$R_{12}$ ; 1; $-i, 1$ ;	
$T'$ ; $MK$ ; $C_{21}'', C_2 \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	
$S'$ ; $LH$ ; $C_{21}'', C_2 \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'', \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	
$R$ ; $AL$ ; $C_{21}', C_{21}'', \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	

SG 181

 $\Gamma_h; \{C_6^+|00\frac{2}{3}\}, \{C_{21}'|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000); $C_6^+, C_{21}', \mathcal{T}$ ;	$R_7$ ; 2; $i\sigma_3, i\sigma_1, -i\sigma_2$ ;	C-3 WP; 3
	$R_8$ ; 2; $\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
	$R_9$ ; 2; $\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$M$ ; $(0\frac{1}{2}0)$ ; $C_2, C_{21}'', \mathcal{T}$ ;	$R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$A$ ; $(00\frac{1}{2})$ ; $C_6^+, C_{21}', \mathcal{T}$ ;	$R_7$ ; 2; $i\sigma_3, i\sigma_1, -i\sigma_2$ ;	C-3 WP; 3
	$R_8$ ; 2; $\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
	$R_9$ ; 2; $\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $C_2, C_{21}'', \mathcal{T}$ ;	$R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	C-1 WP; 1
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $C_3^-, C_{21}'', C_6^+ \mathcal{T}$ ;	$R_3$ ; 1; $-1, i, 1$ ;	
	$R_4$ ; 1; $-1, -i, 1$ ;	
	$R_6$ ; 2; $\frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{-\sigma_0+i\sqrt{3}\sigma_2}{2}$ ;	C-1 WP; 1
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $C_3^-, C_{21}'', C_6^+ \mathcal{T}$ ;	$R_3$ ; 1; $-1, i, 1$ ;	
	$R_4$ ; 1; $-1, -i, 1$ ;	
	$R_6$ ; 2; $\frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{-\sigma_0+i\sqrt{3}\sigma_2}{2}$ ;	C-1 WP; 1
$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'', \mathcal{T}$ ;	$R_2$ ; 1; $\sqrt[6]{-1}, 1$ ;	
	$R_4$ ; 1; $i, 1$ ;	
	$R_6$ ; 1; $(-1)^{5/6}, 1$ ;	
	$R_8$ ; 1; $-\sqrt[6]{-1}, 1$ ;	
	$R_{10}$ ; 1; $-i, 1$ ;	
	$R_{12}$ ; 1; $-(-1)^{5/6}, 1$ ;	
$U$ ; ML; $C_2, C_{21}'', \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	
$P$ ; KH; $C_3^+, C_{22}', \mathcal{T}$ ;	$R_2$ ; 1; $\sqrt[3]{-1}, 1$ ;	
	$R_4$ ; 1; $-1, 1$ ;	
	$R_6$ ; 1; $-(-1)^{2/3}, 1$ ;	
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}', \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	
$S$ ; AH; $C_{22}'', C_{22}', \mathcal{T}$ ;	$R_2$ ; 1; $-i, 1$ ;	
	$R_8$ ; 1; $i, 1$ ;	
$T'$ ; MK; $C_{21}'', C_2 \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	
$S'$ ; LH; $C_{21}'', C_2 \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'', \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	
$R$ ; AL; $C_{21}', C_{21}'', \mathcal{T}$ ;	$R_2$ ; 1; $i, 1$ ;	
	$R_4$ ; 1; $-i, 1$ ;	

$\Gamma_h; \{C_6^+|00\frac{1}{2}\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); C_6^+, C_{21}', \mathcal{T};$	$R_7;$	$2; i\sigma_3, i\sigma_1, -i\sigma_2;$	C-3 WP; 3
	$R_8;$	$2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_9;$	$2; \frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$M; (0\frac{1}{2}0); C_2, C_{21}'', \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$A; (00\frac{1}{2}); C_6^+, C_{21}', \mathcal{T};$	$\{R_{10}, R_{11}\};$	$2; \sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
	$\{R_{12}, R_{13}\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
	$R_{14};$	$2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), i\sigma_1, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
	$R_{15};$	$2; \frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), i\sigma_1, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
$L; (0\frac{1}{2}\frac{1}{2}); C_2, C_{21}'', \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
	$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$R_3;$	$1; -1, i, 1;$	
	$R_4;$	$1; -1, -i, 1;$	
	$R_6;$	$2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sigma_0+i\sqrt{3}\sigma_2}{-2};$	C-1 WP; 1
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, C_{21}'', C_6^+ \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>ALH</sub> ;
	$R_6;$	$2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sqrt{3}\sigma_0-i\sigma_2}{-2};$	P-NS <sub>ALH</sub> ;
$\Delta; \Gamma A; C_6^+, C_{23}'', \mathcal{T};$	$R_2;$	$1; \sqrt[6]{-1}, 1;$	
	$R_4;$	$1; i, 1;$	
	$R_6;$	$1; (-1)^{5/6}, 1;$	
	$R_8;$	$1; -\sqrt[6]{-1}, 1;$	
	$R_{10};$	$1; -i, 1;$	
	$R_{12};$	$1; -(-1)^{5/6}, 1;$	
$U; ML; C_2, C_{21}'', \mathcal{T};$	$R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$P; KH; C_3^+, C_{22}', \mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
	$R_4;$	$1; -1, 1;$	
	$R_6;$	$1; -(-1)^{2/3}, 1;$	
$T; \Gamma K; C_{22}'', C_{22}', \mathcal{T};$	$R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$S; AH; C_{22}'', E, C_{22}', \mathcal{T};$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, \sigma_1;$	L-NS <sub>ALH</sub> ;
$T'; MK; C_{21}'', C_2 \mathcal{T};$	$R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$S'; LH; C_{21}'', E, C_2 \mathcal{T};$	$\{R_5, R_7\};$	$2; -i\sigma_3, \sigma_0, -i\sigma_2;$	L-NS <sub>ALH</sub> ;
$\Sigma; \Gamma M; C_{21}', C_{21}'', \mathcal{T};$	$R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$R; AL; C_{21}', C_{21}'', \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, \sigma_1;$	L-NS <sub>ALH</sub> ;

$\Gamma_h; \{C_6^+|000\}, \{\sigma_{d1}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); C_6^+, \sigma_{d1}, \mathcal{T};$	$R_7; 2; i\sigma_3, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
	$R_8; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
	$R_9; 2; \frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0); C_2, \sigma_{v1}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{ML};$	
$A; (00\frac{1}{2}); C_6^+, \sigma_{d1}, \mathcal{T};$	$R_7; 2; i\sigma_3, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
	$R_8; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
	$R_9; 2; \frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
$L; (0\frac{1}{2}\frac{1}{2}); C_2, \sigma_{v1}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{ML};$	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, \sigma_{d1}, \mathcal{T}\sigma_{v3};$	$R_3; 1; -1, i, 1;$		
	$R_4; 1; -1, -i, 1;$		
	$R_6; 2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sqrt{3}\sigma_1+\sigma_3}{2i};$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, \sigma_{d1}, \mathcal{T}\sigma_{v3};$	$R_3; 1; -1, i, 1;$		
	$R_4; 1; -1, -i, 1;$		
	$R_6; 2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sqrt{3}\sigma_1+\sigma_3}{2i};$	P-WNL $_{KH};$	
$\Delta; \Gamma A; C_6^+, \sigma_{d1};$	$R_7; 2; i\sigma_3, i\sigma_1;$	CNL;	$\pi$
	$R_8; 2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	WNL;	$\pi$
	$R_9; 2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	WNL;	$\pi$
$U; ML; C_2, \sigma_{v1};$	$R_5; 2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$P; KH; C_3^+, \sigma_{d1};$	$R_3; 1; -1, i;$		
	$R_4; 1; -1, -i;$		
	$R_6; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$T; \Gamma K; \sigma_{d2}, C_2\mathcal{T};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
	$R_6; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$S; AH; \sigma_{d2}, C_2\mathcal{T};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
	$R_6; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$T'; MK; \sigma_{d1}, \mathcal{T}\sigma_{v1};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
	$R_6; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$S'; LH; \sigma_{d1}, \mathcal{T}\sigma_{v1};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
	$R_6; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma M; \sigma_{v1}, C_2\mathcal{T};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
	$R_6; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$R; AL; \sigma_{v1}, C_2\mathcal{T};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
	$R_6; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$

$\Gamma_h; \{C_6^+|000\}, \{\sigma_{d1}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000); C_6^+, \sigma_{d1}, \mathcal{T};$	$R_7;$	$2; i\sigma_3, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
	$R_8;$	$2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
	$R_9;$	$2; \frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0); C_2, \sigma_{v1}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{ML};$	
$A; (00\frac{1}{2}); C_6^+, \sigma_{d1}, \mathcal{T};$	$\{R_7, R_7\};$	$4; \frac{\sqrt{3}\Gamma_{0,0}+i\Gamma_{0,3}}{2}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
	$\{R_8, R_8\};$	$4; \frac{\sqrt{3}\Gamma_{0,0}-i\Gamma_{0,3}}{-2}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	CDP;	0
$L; (0\frac{1}{2}\frac{1}{2}); C_2, \sigma_{v1}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, \sigma_{d1}, \mathcal{T}\sigma_{v3};$	$R_3;$	$1; -1, i, 1;$		
	$R_4;$	$1; -1, -i, 1;$		
	$R_6;$	$2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sqrt{3}\sigma_1+\sigma_3}{2i};$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, \sigma_{d1}, \mathcal{T}\sigma_{v3};$	$\{R_1, R_2\};$	$2; \sigma_0, \sigma_3, -i\sigma_2;$	P-WNLs;	
	$\{R_5, R_5\};$	$4; \frac{\Gamma_{0,0}+i\sqrt{3}\Gamma_{0,2}}{-2}, \Gamma_{0,3}, \frac{\Gamma_{2,1}+\sqrt{3}\Gamma_{2,3}}{-2};$	DP;	0
$\Delta; \Gamma A; C_6^+, \sigma_{d1};$	$R_7;$	$2; i\sigma_3, i\sigma_1;$	CNL;	$\pi$
	$R_8;$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	WNL;	$\pi$
	$R_9;$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	WNL;	$\pi$
$U; ML; C_2, \sigma_{v1};$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$P; KH; C_3^+, \sigma_{d1};$	$R_3;$	$1; -1, i;$		
	$R_4;$	$1; -1, -i;$		
	$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$T; \Gamma K; \sigma_{d2}, C_2\mathcal{T};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$S; AH; \sigma_{d2}, C_2\mathcal{T};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$
$T'; MK; \sigma_{d1}, \mathcal{T}\sigma_{v1};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$S'; LH; \sigma_{d1}, \mathcal{T}\sigma_{v1};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Sigma; \Gamma M; \sigma_{v1}, C_2\mathcal{T};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$R; AL; \sigma_{v1}, C_2\mathcal{T};$	$\{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	WNL;	$\pi$

$\Gamma_h; \{C_6^+ | 00\frac{1}{2}\}, \{\sigma_{d1} | 000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_6^+, \sigma_{d1}, \mathcal{T};$	$R_7;$	$2; i\sigma_3, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
		$R_8;$	$2; \frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
		$R_9;$	$2; \frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0);$	$C_2, \sigma_{v1}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{ML};$	
$A; (00\frac{1}{2});$	$C_3^+, \sigma_{d1}, C_2, \mathcal{T};$	$\{R_{13}, R_{13}\};$	$4; -\Gamma_{0,0}, i\Gamma_{0,1}, \Gamma_{0,3}, -\Gamma_{2,3};$	CDP;	0
		$\{R_{14}, R_{15}\};$	$4; \frac{\Gamma_{0,0} + i\sqrt{3}\Gamma_{0,2}}{2}, i\Gamma_{3,3}, \Gamma_{3,2}, -i\Gamma_{2,0};$	DP;	0
$L; (0\frac{1}{2}\frac{1}{2});$	$\sigma_{d1}, \sigma_{v1}, \mathcal{T};$	$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0
$K; (\frac{1}{3}\frac{2}{3}0);$	$C_3^+, \sigma_{d1}, \mathcal{T}\sigma_{v3};$	$R_3;$	$1; -1, i, 1;$		
		$R_4;$	$1; -1, -i, 1;$		
		$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sqrt{3}\sigma_1 + \sigma_3}{2i};$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2});$	$C_3^+, \sigma_{d1}, \mathcal{T}\sigma_{v3};$	$\{R_3, R_3\};$	$2; -\sigma_0, i\sigma_0, -i\sigma_2;$	P-NS $_{ALH};$	
		$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_0, -i\sigma_2;$	P-NS $_{ALH};$	
		$\{R_6, R_6\};$	$4; \frac{\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2}}{2}, i\Gamma_{0,3}, \frac{\sqrt{3}\Gamma_{2,1} + \Gamma_{2,3}}{-2};$	DP;	0
$\Delta; \Gamma A;$	$C_6^+, \sigma_{d1};$	$R_7;$	$2; i\sigma_3, i\sigma_1;$	CNL;	$\pi$
		$R_8;$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	WNL;	$\pi$
		$R_9;$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	WNL;	$\pi$
$U; ML;$	$C_2, \sigma_{v1};$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$P; KH;$	$C_3^+, \sigma_{d1};$	$R_3;$	$1; -1, i;$		
		$R_4;$	$1; -1, -i;$		
		$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$T; \Gamma K;$	$\sigma_{d2}, C_2 \mathcal{T};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
		$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$	L-NS $_{ALH};$	
$S; AH;$	$\sigma_{d2}, C_2 \mathcal{T};$	$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$	L-NS $_{ALH};$	
$T'; MK;$	$\sigma_{d1}, \mathcal{T}\sigma_{v1};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
		$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$	L-NS $_{ALH};$	
$S'; LH;$	$\sigma_{d1}, \mathcal{T}\sigma_{v1};$	$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$	L-NS $_{ALH};$	
$\Sigma; \Gamma M;$	$\sigma_{v1}, C_2 \mathcal{T};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$R; AL;$	$\sigma_{v1}, C_2 \mathcal{T};$	$\{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	L-NS $_{ALH};$	

$\Gamma_h; \{C_6^+ | 00\frac{1}{2}\}, \{\sigma_{d1} | 00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); C_6^+, \sigma_{d1}, \mathcal{T};$	$R_7;$	$2; i\sigma_3, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
	$R_8;$	$2; \frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
	$R_9;$	$2; \frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma A};$	
$M; (0\frac{1}{2}0); C_2, \sigma_{v1}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{ML};$	
$A; (00\frac{1}{2}); C_3^+, \sigma_{v1}, C_2, \mathcal{T}; \{R_{13}, R_{13}\};$	$4; -\Gamma_{0,0}, i\Gamma_{0,1}, \Gamma_{0,3}, -\Gamma_{2,3};$	CDP;	0	
	$\{R_{14}, R_{15}\}; 4; \frac{\Gamma_{0,0} + i\sqrt{3}\Gamma_{0,2}}{2}, i\Gamma_{3,3}, \Gamma_{3,2}, -i\Gamma_{2,0};$	DP;	0	
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{v1}, \sigma_{d1}, \mathcal{T}; \{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;	0	
$K; (\frac{1}{3}\frac{2}{3}0); C_3^+, \sigma_{d1}, \mathcal{T}\sigma_{v3}; R_3;$	$1; -1, i, 1;$			
	$R_4;$	$1; -1, -i, 1;$		
	$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sqrt{3}\sigma_1 + \sigma_3}{2i};$	P-WNL $_{KH};$	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); C_3^+, \sigma_{d1}, \mathcal{T}\sigma_{v3}; \{R_1, R_2\};$	$2; \sigma_0, \sigma_3, \sigma_1;$	P-NS $_{ALH};$		
	$R_5;$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_2}{-2}, \sigma_3, \frac{\sigma_1 + \sqrt{3}\sigma_3}{2i};$	P-WNL/NS;	
$\Delta; \Gamma A; C_6^+, \sigma_{d1};$	$R_7;$	$2; i\sigma_3, i\sigma_1;$	CNL;	$\pi$
	$R_8;$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	WNL;	$\pi$
	$R_9;$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	WNL;	$\pi$
$U; ML; C_2, \sigma_{v1};$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$P; KH; C_3^+, \sigma_{d1};$	$R_3;$	$1; -1, i;$		
	$R_4;$	$1; -1, -i;$		
	$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$T; \Gamma K; \sigma_{d2}, C_2\mathcal{T};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$S; AH; \sigma_{d2}, C_2\mathcal{T}; \{R_2, R_4\};$	$2; \sigma_3, -i\sigma_2;$	L-NS $_{ALH};$		
$T'; MK; \sigma_{d1}, \mathcal{T}\sigma_{v1};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$S'; LH; \sigma_{d1}, \mathcal{T}\sigma_{v1}; \{R_2, R_4\};$	$2; \sigma_3, \sigma_1;$	L-NS $_{ALH};$		
$\Sigma; \Gamma M; \sigma_{v1}, C_2\mathcal{T};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$R; AL; \sigma_{v1}, C_2\mathcal{T};$	$\{R_2, R_2\};$	$2; i\sigma_0, -i\sigma_2;$	L-NS $_{ALH};$	
	$\{R_4, R_4\};$	$2; -i\sigma_0, -i\sigma_2;$	L-NS $_{ALH};$	

$\Gamma_h; \{S_3^+|000\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); S_3^+, C_{21}', \mathcal{T};$	$R_7; 2; i\sigma_3, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_8; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_9; 2; \frac{\sqrt{3}\sigma_0-i\sigma_3}{-2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
$M; (0\frac{1}{2}0); C_{21}', \sigma_{v1}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma M};$	
$A; (00\frac{1}{2}); S_3^+, C_{21}', \mathcal{T};$	$R_7; 2; i\sigma_3, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_8; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_9; 2; \frac{\sqrt{3}\sigma_0-i\sigma_3}{-2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
$L; (0\frac{1}{2}\frac{1}{2}); C_{21}', \sigma_{v1}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{AL};$	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, \mathcal{T}\sigma_{v2};$	$R_2; 1; \sqrt[6]{-1}, 1;$		
	$R_4; 1; i, 1;$		
	$R_6; 1; (-1)^{5/6}, 1;$		
	$R_8; 1; -\sqrt[6]{-1}, 1;$		
	$R_{10}; 1; -i, 1;$		
	$R_{12}; 1; -(-1)^{5/6}, 1;$		
	$R_2; 1; \sqrt[6]{-1}, 1;$		
	$R_4; 1; i, 1;$		
	$R_6; 1; (-1)^{5/6}, 1;$		
	$R_8; 1; -\sqrt[6]{-1}, 1;$		
	$R_{10}; 1; -i, 1;$		
	$R_{12}; 1; -(-1)^{5/6}, 1;$		
$\Delta; \Gamma A; C_3^+, \sigma_{v1}, S_3^+ \mathcal{T};$	$R_3; 1; -1, i, 1;$		
	$R_4; 1; -1, -i, 1;$		
	$R_6; 2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sigma_0-i\sqrt{3}\sigma_2}{-2};$	QNL;	0
$U; ML; \sigma_{v1}, \mathcal{T}\sigma_h;$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$P; KH; C_3^+, C_{23}' \mathcal{T};$	$R_2; 1; \sqrt[3]{-1}, 1;$		
	$R_4; 1; -1, 1;$		
	$R_6; 1; -(-1)^{2/3}, 1;$		
$T; \Gamma K; \sigma_h, \mathcal{T}\sigma_{v2};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$S; AH; \sigma_h, \mathcal{T}\sigma_{v2};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$T'; MK; \sigma_h, \mathcal{T}\sigma_{v1};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$S'; LH; \sigma_h, \mathcal{T}\sigma_{v1};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$\Sigma; \Gamma M; C_{21}', \sigma_{v1};$	$R_5; 2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$R; AL; C_{21}', \sigma_{v1};$	$R_5; 2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$



$\Gamma_h; \{S_3^+|000\}, \{C_{21}'|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000); S_3^+, C_{21}', \mathcal{T};$	$R_7;$	$2; i\sigma_3, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_8;$	$2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_9;$	$2; \frac{\sqrt{3}\sigma_0-i\sigma_3}{-2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
$M; (0\frac{1}{2}0); C_{21}', \sigma_{v1}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma M};$	
$A; (00\frac{1}{2}); \sigma_{v1}, C_3^+, \sigma_h, \mathcal{T}; \{R_5, R_7\};$	$2; \sigma_0, -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNLs;		
	$\{R_6, R_8\};$	$2; -\sigma_0, -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNLs;	
	$\{R_{11}, R_{12}\};$	$4; \Gamma_{0,1}, \frac{\Gamma_{0,0}+i\sqrt{3}\Gamma_{3,3}}{2}, i\Gamma_{3,0}, -i\Gamma_{2,0};$	DP;	0
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{v1}, \sigma_h, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL $_{LH};$	
	$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL $_{LH};$	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, \mathcal{T}\sigma_{v2};$	$R_2;$	$1; \sqrt[6]{-1}, 1;$		
	$R_4;$	$1; i, 1;$		
	$R_6;$	$1; (-1)^{5/6}, 1;$		
	$R_8;$	$1; -\sqrt[6]{-1}, 1;$		
	$R_{10};$	$1; -i, 1;$		
	$R_{12};$	$1; -(-1)^{5/6}, 1;$		
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+, \mathcal{T}\sigma_{v2};$	$\{R_2, R_8\};$	$2; \sqrt[6]{-1}\sigma_3, -i\sigma_2;$	P-WNLs;	
	$\{R_4, R_{10}\};$	$2; i\sigma_3, -i\sigma_2;$	P-WNLs;	
	$\{R_6, R_{12}\};$	$2; (-1)^{5/6}\sigma_3, -i\sigma_2;$	P-WNLs;	
$\Delta; \Gamma A; C_3^+, \sigma_{v1}, S_3^+ \mathcal{T};$	$R_3;$	$1; -1, i, 1;$		
	$R_4;$	$1; -1, -i, 1;$		
	$R_6;$	$2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sigma_0-i\sqrt{3}\sigma_2}{-2};$	QNL;	0
$U; \text{ML}; \sigma_{v1}, \mathcal{T}\sigma_h;$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$P; \text{KH}; C_3^+, C_{23}' \mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$		
	$R_4;$	$1; -1, 1;$		
	$R_6;$	$1; -(-1)^{2/3}, 1;$		
$T; \Gamma K; \sigma_h, \mathcal{T}\sigma_{v2};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$S; \text{AH}; \sigma_h, \mathcal{T}\sigma_{v2};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$T'; \text{MK}; \sigma_h, \mathcal{T}\sigma_{v1};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$S'; \text{LH}; \sigma_h, \mathcal{T}\sigma_{v1};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$
$\Sigma; \Gamma M; C_{21}', \sigma_{v1};$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$R; \text{AL}; C_{21}', \sigma_h;$	$R_5;$	$1; i, i;$		
	$R_6;$	$1; i, -i;$		
	$R_7;$	$1; -i, -i;$		
	$R_8;$	$1; -i, i;$		

$\Gamma_h; \{S_3^+|000\}, \{C_{21}''|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); S_3^+, C_{21}'', \mathcal{T};$	$R_7; 2; i\sigma_3, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_8; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_9; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{-2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
$M; (0\frac{1}{2}0); C_{21}'', \sigma_{d1}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL <sub>LMK</sub> ;	
$A; (00\frac{1}{2}); S_3^+, C_{21}'', \mathcal{T};$	$R_7; 2; i\sigma_3, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_8; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_9; 2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{-2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
$L; (0\frac{1}{2}\frac{1}{2}); C_{21}'', \sigma_{d1}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL <sub>LH</sub> ;	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, C_{21}'';$	$R_7; 2; i\sigma_3, i\sigma_1;$	P-WNLs;	
	$R_8; 2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	P-WNLs;	
	$R_9; 2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	P-WNLs;	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+, C_{21}'';$	$R_7; 2; i\sigma_3, i\sigma_1;$	P-WNLs;	
	$R_8; 2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	P-WNLs;	
	$R_9; 2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1;$	P-WNLs;	
$\Delta; \Gamma A; C_3^+, \sigma_{d1}, S_3^+ \mathcal{T};$	$R_3; 1; -1, i, 1;$		
	$R_4; 1; -1, -i, 1;$		
	$R_6; 2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sigma_0+i\sqrt{3}\sigma_2}{-2};$	QNL;	0
$U; ML; \sigma_{d1}, \mathcal{T}\sigma_h;$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$P; KH; C_3^+, \sigma_{d1};$	$R_3; 1; -1, i;$		
	$R_4; 1; -1, -i;$		
	$R_6; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$T; \Gamma K; C_{22}'', \sigma_{d2};$	$R_5; 2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$S; AH; C_{22}'', \sigma_{d2};$	$R_5; 2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$T'; MK; C_{21}'', \sigma_{d1};$	$R_5; 2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$S'; LH; C_{21}'', \sigma_{d1};$	$R_5; 2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$\Sigma; \Gamma M; \sigma_h, \mathcal{T}\sigma_{d1};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		
$R; AL; \sigma_h, \mathcal{T}\sigma_{d1};$	$R_2; 1; i, 1;$		
	$R_4; 1; -i, 1;$		

$\Gamma_h; \{S_3^+|000\}, \{C_{21}''|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000); S_3^+, C_{21}'', \mathcal{T};$	$R_7;$	$2; i\sigma_3, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_8;$	$2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
	$R_9;$	$2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{-2}, i\sigma_1, -i\sigma_2;$	P-WNLs;	
$M; (0\frac{1}{2}0); C_{21}'', \sigma_{d1}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL <sub>MK</sub> ;	
$A; (00\frac{1}{2}); \sigma_{d1}, C_3^+, \sigma_h, \mathcal{T}; \{R_5, R_7\};$		$2; \sigma_0, -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNLs;	
	$\{R_6, R_8\};$	$2; -\sigma_0, -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNLs;	
	$\{R_{11}, R_{12}\};$	$4; \Gamma_{0,1}, \frac{\Gamma_{0,0}+i\sqrt{3}\Gamma_{3,3}}{2}, i\Gamma_{3,0}, -i\Gamma_{2,0};$	DP;	0
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{d1}, \sigma_h, \mathcal{T};$	$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL <sub>AL</sub> ;	
	$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL <sub>AL</sub> ;	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, C_{21}'';$	$R_7;$	$2; i\sigma_3, i\sigma_1;$	P-WNLs;	
	$R_8;$	$2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1;$	P-WNLs;	
	$R_9;$	$2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{-2}, i\sigma_1;$	P-WNLs;	
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); \sigma_{d1}, C_3^+, \sigma_h;$	$R_5;$	$1; 1, -1, i;$		
	$R_6;$	$1; -1, -1, i;$		
	$R_7;$	$1; 1, -1, -i;$		
	$R_8;$	$1; -1, -1, -i;$		
	$R_{11};$	$2; \sigma_1, \frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, i\sigma_0;$	P-WNL <sub>KH</sub> ;	
	$R_{12};$	$2; \sigma_1, \frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, -i\sigma_0;$	P-WNL <sub>KH</sub> ;	
$\Delta; \Gamma A; C_3^+, \sigma_{d1}, S_3^+ \mathcal{T};$	$R_3;$	$1; -1, i, 1;$		
	$R_4;$	$1; -1, -i, 1;$		
	$R_6;$	$2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, \frac{\sigma_0+i\sqrt{3}\sigma_2}{-2};$	QNL;	0
$U; \text{ML}; \sigma_{d1}, \mathcal{T}\sigma_h;$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$P; \text{KH}; C_3^+, \sigma_{d1};$	$R_3;$	$1; -1, i;$		
	$R_4;$	$1; -1, -i;$		
	$R_6;$	$2; \frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	WNL;	$\pi$
$T; \Gamma K; C_{22}'', \sigma_{d2};$	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$S; \text{AH}; C_{22}'', \sigma_h;$	$R_5;$	$1; i, i;$		
	$R_6;$	$1; i, -i;$		
	$R_7;$	$1; -i, -i;$		
	$R_8;$	$1; -i, i;$		
	$R_5;$	$2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$T'; \text{MK}; C_{21}'', \sigma_{d1};$	$R_5;$	$1; i, i;$		
$S'; \text{LH}; C_{21}'', \sigma_h;$	$R_6;$	$1; i, -i;$		
	$R_7;$	$1; -i, -i;$		
	$R_8;$	$1; -i, i;$		
	$R_2;$	$1; i, 1;$		
$\Sigma; \Gamma M; \sigma_h, \mathcal{T}\sigma_{d1};$	$R_4;$	$1; -i, 1;$		
$R; \text{AL}; \sigma_h, \mathcal{T}\sigma_{d1};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	WNL;	$\pi$

SG 191

 $\Gamma_h; \{C_6^+|000\}, \{C_{21}'|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_6^+, C_{21}', I, \mathcal{T}; R_7;$	$2; i\sigma_3, i\sigma_1, \sigma_0, -i\sigma_2;$
$R_8;$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, \sigma_0, -i\sigma_2;$
$R_9;$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, \sigma_0, -i\sigma_2;$
$R_{16};$	$2; i\sigma_3, i\sigma_1, -\sigma_0, -i\sigma_2;$
$R_{17};$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -\sigma_0, -i\sigma_2;$
$R_{18};$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -\sigma_0, -i\sigma_2;$
$M; (0\frac{1}{2}0); C_2, C_{21}'', I, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$A; (00\frac{1}{2}); C_6^+, C_{21}', I, \mathcal{T}; R_7;$	$2; i\sigma_3, i\sigma_1, \sigma_0, -i\sigma_2;$
$R_8;$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, \sigma_0, -i\sigma_2;$
$R_9;$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, \sigma_0, -i\sigma_2;$
$R_{16};$	$2; i\sigma_3, i\sigma_1, -\sigma_0, -i\sigma_2;$
$R_{17};$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -\sigma_0, -i\sigma_2;$
$R_{18};$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -\sigma_0, -i\sigma_2;$
$L; (0\frac{1}{2}\frac{1}{2}); C_2, C_{21}'', I, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$
$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, C_{21}'', I, \mathcal{T}; R_7;$	$2; i\sigma_3, i\sigma_1, -i\sigma_2;$
$R_8;$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$
$R_9;$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+, C_{21}'', I, \mathcal{T}; R_7;$	$2; i\sigma_3, i\sigma_1, -i\sigma_2;$
$R_8;$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$
$R_9;$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$
$\Delta; \Gamma A; C_6^+, \sigma_{d1}, I, \mathcal{T}; R_7;$	$2; i\sigma_3, i\sigma_1, -i\sigma_2;$
$R_8;$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$
$R_9;$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$
$U; ML; C_2, \sigma_{v1}, I, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$P; KH; C_3^+, \sigma_{d1}, I, \mathcal{T}; \{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$
$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$
$T; \Gamma K; C_{22}'', \sigma_{d2}, I, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$S; AH; C_{22}'', \sigma_{d2}, I, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$T'; MK; C_{21}'', \sigma_{d1}, I, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$S'; LH; C_{21}'', \sigma_{d1}, I, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Sigma; \Gamma M; C_{21}', \sigma_{v1}, I, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$R; AL; C_{21}', \sigma_{v1}, I, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$

$\Gamma_h; \{C_6^+|000\}, \{C_{21}'|00\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_6^+, C_{21}', I, \mathcal{T};$	$R_7;$	$2; i\sigma_3, i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_8;$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_9;$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_{16};$	$2; i\sigma_3, i\sigma_1, -\sigma_0, -i\sigma_2;$	
	$R_{17};$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -\sigma_0, -i\sigma_2;$	
	$R_{18};$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -\sigma_0, -i\sigma_2;$	
$M; (0\frac{1}{2}0); C_2, C_{21}'', I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$A; (00\frac{1}{2}); \sigma_{d1}, C_3^+, \sigma_h, C_2, \mathcal{T};$	$\{R_{19}, R_{20}\};$	$4; \Gamma_{0,1}, -\Gamma_{0,0}, i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{2,0};$	CDP; 0
	$\{R_{21}, R_{23}\};$	$4; \Gamma_{0,1}, \frac{\Gamma_{0,0}+i\sqrt{3}\Gamma_{3,3}}{2}, i\Gamma_{3,0}, -i\Gamma_{3,3}, -i\Gamma_{2,0};$	DP; 0
	$\{R_{22}, R_{24}\};$	$4; \Gamma_{0,1}, \frac{\Gamma_{0,0}+i\sqrt{3}\Gamma_{3,3}}{2}, i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{2,0};$	DP; 0
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{d1}, \sigma_h, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	$4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, C_{21}'', I, \mathcal{T};$	$R_7;$	$2; i\sigma_3, i\sigma_1, -i\sigma_2;$	
	$R_8;$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$	
	$R_9;$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$	
	$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); \sigma_{d1}, C_3^+, \sigma_h, I, \mathcal{T};$	$\{R_5, R_8\};$	$2; \sigma_3, -\sigma_0, i\sigma_3, -i\sigma_2;$
$\Delta; \Gamma A; C_6^+, \sigma_{d1}, I, \mathcal{T};$	$\{R_6, R_7\};$	$2; -\sigma_3, -\sigma_0, i\sigma_3, -i\sigma_2;$	
	$\{R_{11}, R_{12}\};$	$4; \Gamma_{3,1}, \frac{\Gamma_{0,0}+i\sqrt{3}\Gamma_{3,3}}{2}, i\Gamma_{3,0}, -i\Gamma_{2,0};$	DP; 0
	$R_7;$	$2; i\sigma_3, i\sigma_1, -i\sigma_2;$	
	$R_8;$	$2; \frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$	
$U; ML; C_2, \sigma_{v1}, I, \mathcal{T};$	$R_9;$	$2; \frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$	
	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
	$P; KH; C_3^+, \sigma_{d1}, I, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$
$T; \Gamma K; C_{22}'', \sigma_{d2}, I, \mathcal{T};$	$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
	$S; AH; C_{22}'', \sigma_h, I, \mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, i\sigma_3, -i\sigma_2;$
$T'; MK; C_{21}'', \sigma_{d1}, I, \mathcal{T};$	$\{R_7, R_8\};$	$2; -i\sigma_0, -i\sigma_3, -i\sigma_2;$	
	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
	$S'; LH; C_{21}'', \sigma_h, I, \mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, i\sigma_3, -i\sigma_2;$
$\Sigma; \Gamma M; C_{21}', \sigma_{v1}, I, \mathcal{T};$	$\{R_7, R_8\};$	$2; -i\sigma_0, -i\sigma_3, -i\sigma_2;$	
	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
	$R; AL; C_{21}', \sigma_h, I, \mathcal{T};$	$\{R_5, R_6\};$	$2; i\sigma_0, i\sigma_3, -i\sigma_2;$
	$\{R_7, R_8\};$	$2; -i\sigma_0, -i\sigma_3, -i\sigma_2;$	

$\Gamma_h; \{C_6^+|00\frac{1}{2}\}, \{C_{21}'|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_6^+, C_{21}', I, \mathcal{T};$	$R_7;$	2;	$i\sigma_3, i\sigma_1, \sigma_0, -i\sigma_2;$		
	$R_8;$	2;	$\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, \sigma_0, -i\sigma_2;$		
	$R_9;$	2;	$\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, \sigma_0, -i\sigma_2;$		
	$R_{16};$	2;	$i\sigma_3, i\sigma_1, -\sigma_0, -i\sigma_2;$		
	$R_{17};$	2;	$\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
	$R_{18};$	2;	$\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$M; (0\frac{1}{2}0); C_2, C_{21}'', I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$		
	$R_{10};$	2;	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$A; (00\frac{1}{2}); C_6^+, C_{21}', I, \mathcal{T}; \{R_{15}, R_{16}\};$	$R_{15}, R_{16};$	4;	$\Gamma_{0,3}, i\Gamma_{3,0}, \Gamma_{0,1}, -i\Gamma_{2,0};$	P-DNLs;	
	$R_{24};$	4;	$\frac{\Gamma_{3,0}-i\sqrt{3}\Gamma_{3,3}}{-2}, i\Gamma_{0,1}, \Gamma_{1,3}, -i\Gamma_{3,2};$	P-DNLs;	
$L; (0\frac{1}{2}\frac{1}{2}); \sigma_{v1}, C_{21}', I, \mathcal{T}; \{R_{13}, R_{14}\};$	$R_{13}, R_{14};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	P-DNL <sub>LH</sub> ;	
$K; (\frac{1}{3}\frac{2}{3}0); S_3^+, C_{21}'', I, \mathcal{T};$	$R_7;$	2;	$i\sigma_3, i\sigma_1, -i\sigma_2;$		
	$R_8;$	2;	$\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$		
	$R_9;$	2;	$\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$		
	$R_{10};$	2;	$i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$		
$H; (\frac{1}{3}\frac{2}{3}\frac{1}{2}); S_3^+, C_{21}'', I, \mathcal{T}; \{R_7, R_8\};$	$R_7, R_8;$	4;	$i\Gamma_{0,3}, i\Gamma_{0,1}, i\Gamma_{2,0};$	P-DNLs;	
	$\{R_8, R_9\};$	4;	$\frac{\sqrt{3}\Gamma_{3,0}+i\Gamma_{0,3}}{2}, i\Gamma_{0,1}, -i\Gamma_{2,0};$	P-DNLs;	
$\Delta; \Gamma A; C_6^+, \sigma_{d1}, I, \mathcal{T};$	$R_7;$	2;	$i\sigma_3, i\sigma_1, -i\sigma_2;$		
	$R_8;$	2;	$\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2;$		
	$R_9;$	2;	$\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}, i\sigma_1, -i\sigma_2;$		
$U; ML; C_2, \sigma_{v1}, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$P; KH; C_3^+, \sigma_{d1}, I, \mathcal{T}; \{R_3, R_4\};$	$R_3, R_4;$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$		
	$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$		
$T; \Gamma K; C_{22}'', \sigma_{d2}, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$S; AH; \sigma_{d2}, C_{22}'', I, \mathcal{T}; \{R_9, R_9\};$	$R_9, R_9;$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$T'; MK; C_{21}'', \sigma_{d1}, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$S'; LH; \sigma_{d1}, C_{21}'', I, \mathcal{T}; \{R_9, R_9\};$	$R_9, R_9;$	4;	$i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1};$	DNL;	0
$\Sigma; \Gamma M; C_{21}', \sigma_{v1}, I, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$		
$R; AL; \sigma_h, C_{21}', I, \mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$		
	$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$		

$\Gamma_h; \{C_6^+|00\frac{1}{2}\}, \{C_{21}'|00\frac{1}{2}\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; $(000)$ ; $C_6^+, C_{21}', I, \mathcal{T}$ ;	$R_7$ ;	2; $i\sigma_3, i\sigma_1, \sigma_0, -i\sigma_2$ ;	
	$R_8$ ;	2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, \sigma_0, -i\sigma_2$ ;	
	$R_9$ ;	2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, \sigma_0, -i\sigma_2$ ;	
	$R_{16}$ ;	2; $i\sigma_3, i\sigma_1, -\sigma_0, -i\sigma_2$ ;	
	$R_{17}$ ;	2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -\sigma_0, -i\sigma_2$ ;	
	$R_{18}$ ;	2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -\sigma_0, -i\sigma_2$ ;	
$M$ ; $(0\frac{1}{2}0)$ ; $C_2, C_{21}'', I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2$ ;	
	$R_{10}$ ;	2; $i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2$ ;	
$A$ ; $(00\frac{1}{2})$ ; $C_6^+, C_{21}'', I, \mathcal{T}$ ;	$\{R_{15}, R_{16}\}$ ;	4; $\Gamma_{0,3}, i\Gamma_{3,0}, \Gamma_{0,1}, -i\Gamma_{2,0}$ ;	P-DNLs;
	$R_{24}$ ;	4; $\frac{1}{2}(-\Gamma_{3,0} + i\sqrt{3}\Gamma_{3,3}), i\Gamma_{0,1}, \Gamma_{1,3}, -i\Gamma_{3,2}$ ;	P-DNLs;
$L$ ; $(0\frac{1}{2}\frac{1}{2})$ ; $\sigma_{d1}, C_{21}'', I, \mathcal{T}$ ;	$\{R_{13}, R_{14}\}$ ;	4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ;	P-DNL <sub>AL</sub> ;
$K$ ; $(\frac{1}{3}\frac{2}{3}0)$ ; $S_3^+, C_{21}'', I, \mathcal{T}$ ;	$R_7$ ;	2; $i\sigma_3, i\sigma_1, -i\sigma_2$ ;	
	$R_8$ ;	2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2$ ;	
	$R_9$ ;	2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2$ ;	
$H$ ; $(\frac{1}{3}\frac{2}{3}\frac{1}{2})$ ; $\sigma_{d1}, C_3^+, \sigma_h, I, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $\sigma_3, -\sigma_0, i\sigma_0, -i\sigma_2$ ;	
	$\{R_7, R_8\}$ ;	2; $\sigma_3, -\sigma_0, -i\sigma_0, -i\sigma_2$ ;	
	$R_{11}$ ;	2; $\sigma_1, \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), i\sigma_0, -i\sigma_2$ ;	
	$R_{12}$ ;	2; $\sigma_1, \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_0, -i\sigma_2$ ;	
$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{d1}, I, \mathcal{T}$ ;	$R_7$ ;	2; $i\sigma_3, i\sigma_1, -i\sigma_2$ ;	
	$R_8$ ;	2; $\frac{1}{2}(\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2$ ;	
	$R_9$ ;	2; $\frac{1}{2}(-\sqrt{3}\sigma_0 + i\sigma_3), i\sigma_1, -i\sigma_2$ ;	
$U$ ; ML; $C_2, \sigma_{v1}, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	
$P$ ; KH; $C_3^+, \sigma_{d1}, I, \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	
	$R_6$ ;	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2$ ;	
$T$ ; $\Gamma K$ ; $C_{22}'', \sigma_{d2}, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	
$S$ ; AH; $\sigma_h, C_{22}'', I, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $i\sigma_0, i\sigma_3, -i\sigma_2$ ;	
	$\{R_7, R_8\}$ ;	2; $-i\sigma_0, -i\sigma_3, -i\sigma_2$ ;	
$T'$ ; MK; $C_{21}'', \sigma_{d1}, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	
$S'$ ; LH; $\sigma_h, C_{21}'', I, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $i\sigma_0, i\sigma_3, -i\sigma_2$ ;	
	$\{R_7, R_8\}$ ;	2; $-i\sigma_0, -i\sigma_3, -i\sigma_2$ ;	
$\Sigma$ ; $\Gamma M$ ; $C_{21}', \sigma_{v1}, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	
$R$ ; AL; $\sigma_{v1}, \sigma_h, I, \mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4; $i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1}$ ;	DNL; 0

SG 195

 $\Gamma_c; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{31}^-, C_{2x}, \bar{C}_{2y}, \mathcal{T};$	$R_4;$	$2; -\sigma_6, -i\sigma_1, i\sigma_2, -i\sigma_2;$	C-1 WP; 1
		$\{R_5, R_6\};$	$4; \Gamma_{11}, -i\Gamma_{3,1}, i\Gamma_{0,2}, -i\Gamma_{2,0};$	C-4 DP; 4
$X; (0\frac{1}{2}0);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{31}^-, C_{2x}, \bar{C}_{2y}, \mathcal{T};$	$R_4;$	$2; -\sigma_6, -i\sigma_1, i\sigma_2, -i\sigma_2;$	C-1 WP; 1
		$\{R_5, R_6\};$	$4; \Gamma_{11}, -i\Gamma_{3,1}, i\Gamma_{0,2}, -i\Gamma_{2,0};$	C-4 DP; 4
$\Delta; \Gamma X;$	$C_{2y}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$\Sigma; \Gamma M;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$\Lambda; \Gamma R;$	$C_{31}^-;$	$R_2;$	$1; \sqrt[3]{-1};$	
		$R_4;$	$1; -1;$	
		$R_6;$	$1; -(-1)^{2/3};$	
$S; XR;$	$\bar{E}, \mathcal{T}C_{2y};$	$R_2;$	$1; -1, 1;$	
$Z; XM;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$T; MR;$	$C_{2z}, \mathcal{T}C_{2x};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	

SG 196

 $\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{31}^-, C_{2x}, \bar{C}_{2y}, \mathcal{T};$	$R_4;$	$2; -\sigma_6, -i\sigma_1, i\sigma_2, -i\sigma_2;$	C-1 WP; 1
		$\{R_5, R_6\};$	$4; \Gamma_{11}, -i\Gamma_{3,1}, i\Gamma_{0,2}, -i\Gamma_{2,0};$	C-4 DP; 4
$X; (\frac{1}{2}0\frac{1}{2});$	$C_{2z}, C_{2y}, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$L; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{31}^+, \mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, -i\sigma_2;$	C-1 WP; 1
		$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$	C-3 WP; 3
$W; (\frac{1}{2}\frac{1}{4}\frac{3}{4});$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$\Delta; \Gamma X;$	$C_{2y}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$\Lambda; \Gamma L;$	$C_{31}^-;$	$R_2;$	$1; \sqrt[3]{-1};$	
		$R_4;$	$1; -1;$	
		$R_6;$	$1; -(-1)^{2/3};$	
$\Sigma; \Gamma \Sigma;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$S; XS;$	$\bar{E}, \mathcal{T}C_{2y};$	$R_2;$	$1; -1, 1;$	
$Z; XW;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$Q; LW;$	$\bar{E};$	$R_2;$	$1; -1;$	



## SG 197

 $\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{31}^-, C_{2x}, C_{2y}, \mathcal{T};$	$R_4;$	$2; -\sigma_6, -i\sigma_1, i\sigma_2, -i\sigma_2;$	C-1 WP; 1
		$\{R_5, R_6\};$	$4; \Gamma_{11}, -i\Gamma_{3,1}, i\Gamma_{0,2}, -i\Gamma_{2,0};$	C-4 DP; 4
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{31}^-, C_{2x}, \bar{C}_{2y}, \mathcal{T};$	$R_4;$	$2; -\sigma_6, -i\sigma_1, i\sigma_2, -i\sigma_2;$	C-1 WP; 1
		$\{R_5, R_6\};$	$4; \Gamma_{11}, -i\Gamma_{3,1}, i\Gamma_{0,2}, -i\Gamma_{2,0};$	C-4 DP; 4
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4});$	$C_{31}^-, C_{2x}, \bar{C}_{2y};$	$R_4;$	$2; -\sigma_6, -i\sigma_1, i\sigma_2;$	C-1 WP; 1
		$R_5;$	$2; -(-1)^{2/3}\sigma_6, -i\sigma_1, i\sigma_2;$	C-1 WP; 1
		$R_6;$	$2; \sqrt[3]{-1}\sigma_6, -i\sigma_1, i\sigma_2;$	C-1 WP; 1
$N; (00\frac{1}{2});$	$C_{2z}, \mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$\Sigma; \Gamma N;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$\Delta; \Gamma H;$	$C_{2y}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
		$R_4;$	$1; -i, 1;$	
$\Lambda; \Gamma P;$	$C_{31}^-;$	$R_2;$	$1; \sqrt[3]{-1};$	
		$R_4;$	$1; -1;$	
		$R_6;$	$1; -(-1)^{2/3};$	
$D; \text{NP};$	$C_{2z};$	$R_2;$	$1; i;$	
		$R_4;$	$1; -i;$	
$G; \text{HN};$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$	
$F; \text{PH};$	$C_{34}^+;$	$R_2;$	$1; \sqrt[3]{-1};$	
		$R_4;$	$1; -1;$	
		$R_6;$	$1; -(-1)^{2/3};$	

## SG 198

 $\Gamma_c; \{C_{31}^-|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\bar{C}_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{31}^-, C_{2x}, \bar{C}_{2y}, \mathcal{T};$	$R_4;$	$2; -\sigma_6, -i\sigma_1, i\sigma_2, -i\sigma_2;$	C-1 WP; 1	
			$\{R_5, R_6\};$	$4; \Gamma_{11}, -i\Gamma_{3,1}, i\Gamma_{0,2}, -i\Gamma_{2,0};$	C-4 DP; 4
$X; (0\frac{1}{2}0);$	$C_{2y}, C_{2x}, \mathcal{T};$		$\{R_5, R_6\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS $_{XMR}$ ;
			$\{R_7, R_8\};$	$2; \sigma_0, -i\sigma_3, -i\sigma_2;$	P-NS $_{XMR}$ ;
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{2z}, C_{2x}, \mathcal{T};$		$\{R_9, R_9\};$	$4; i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1};$	DP;
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{31}^-, C_{2x}, \bar{C}_{2y}, \mathcal{T};$		$\{R_1, R_1\};$	$2; \sigma_0, \sigma_0, \sigma_0, -i\sigma_2;$	P-NSs;
			$\{R_2, R_3\};$	$2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, -i\sigma_2;$	P-NSs;
			$\{R_7, R_7\};$	$6; -S_6, -\frac{S_{0,0}}{3} - \frac{2S_{0,8}}{\sqrt{3}}, -iS_{11}, (-1)^{5/6}S_{2,0};$	C-4 SP; 4
$\Delta; \Gamma X;$	$C_{2y}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
		$R_4;$	$1; -i, 1;$		
$\Sigma; \Gamma M;$	$\bar{E}, \mathcal{T}C_{2z};$	$R_2;$	$1; -1, 1;$		
$\Lambda; \Gamma R;$	$C_{31}^-;$	$R_2;$	$1; \sqrt[3]{-1};$		
		$R_4;$	$1; -1;$		
		$R_6;$	$1; -(-1)^{2/3};$		
$S; \text{XR};$	$\bar{E}, \mathcal{T}C_{2y};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$		L-NS $_{XMR}$ ;
$Z; \text{XM};$	$C_{2x}, \bar{E}, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_0, \sigma_1;$		L-NS $_{XMR}$ ;
$T; \text{MR};$	$C_{2z}, \bar{E}, \mathcal{T}C_{2x};$	$\{R_5, R_5\};$	$2; -i\sigma_0, -\sigma_0, -i\sigma_2;$		L-NSs;
		$\{R_7, R_7\};$	$2; i\sigma_0, -\sigma_0, -i\sigma_2;$		L-NSs;

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 $\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\bar{C}_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 


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$\Gamma; (000); C_{31}^-, C_{2x}, \bar{C}_{2y}, \mathcal{T}; R_4;$	$2; -\sigma_6, -i\sigma_1, i\sigma_2, -i\sigma_2;$	C-1 WP; 1
	$\{R_5, R_6\}; 4; \Gamma_{11}, -i\Gamma_{3,1}, i\Gamma_{0,2}, -i\Gamma_{2,0};$	C-4 DP; 4
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^-, \bar{C}_{2y}, \bar{C}_{2z}, \mathcal{T}; R_4;$	$2; -\sigma_6, -i\sigma_1, i\sigma_2, -i\sigma_2;$	C-1 WP; 1
	$\{R_5, R_6\}; 4; \Gamma_{11}, -i\Gamma_{3,1}, i\Gamma_{0,2}, -i\Gamma_{2,0};$	C-4 DP; 4
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{31}^-, C_{2x}, \bar{C}_{2y};$	$R_1; 1; 1, 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1, 1;$	
	$R_7; 3; A_9, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{10};$	C-2 TP; 2
$N; (00\frac{1}{2}); C_{2z}, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$\Sigma; \Gamma N; \bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	
$\Delta; \Gamma H; C_{2y}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$\Lambda; \Gamma P; C_{31}^-;$	$R_2; 1; \sqrt[3]{-1};$	
	$R_4; 1; -1;$	
	$R_6; 1; -(-1)^{2/3};$	
$D; \text{NP}; C_{2z}, \bar{E};$	$R_5; 1; -i, -1;$	
	$R_7; 1; i, -1;$	
$G; \text{HN}; \bar{E}, \mathcal{T}C_{2z};$	$R_2; 1; -1, 1;$	
$F; \text{PH}; C_{34}^+, \bar{E};$	$R_7; 1; -i, -1;$	
	$R_9; 1; \sqrt[6]{-1}, -1;$	
	$R_{11}; 1; (-1)^{5/6}, -1;$	

SG 200

 $\Gamma_c; \{C_{31}^-|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\bar{C}_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T};$	$R_4;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_7, \sigma_8, \sigma_0, -i\sigma_2;$	
		$\{R_5, R_6\};$	$4; \Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, -i\Gamma_{2,0};$	QCDP; 0
		$R_{11};$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_7, \sigma_8, -\sigma_0, -i\sigma_2;$	
		$\{R_{12}, R_{13}\};$	$4; \Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	QCDP; 0
$X; (0\frac{1}{2}0);$	$C_{2x}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{2x}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$	
		$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T};$	$R_4;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_7, \sigma_8, \sigma_0, -i\sigma_2;$	
		$\{R_5, R_6\};$	$4; \Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, -i\Gamma_{2,0};$	QCDP; 0
		$R_{11};$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_7, \sigma_8, -\sigma_0, -i\sigma_2;$	
		$\{R_{12}, R_{13}\};$	$4; \Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	QCDP; 0
$\Delta; \Gamma X;$	$C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$\Sigma; \Gamma M;$	$\sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	
$\Lambda; \Gamma R;$	$C_{31}^-, I\mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$	
		$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$	
$S; XR;$	$\sigma_y, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	
$Z; XM;$	$C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	$2; \sigma_2, \sigma_1, -i\sigma_2;$	
$T; MR;$	$C_{2z}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; -i\sigma_2, i\sigma_1, -i\sigma_2;$	

SG 201

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 $\Gamma_c; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T};$	$R_4;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_7, \sigma_8, \sigma_0, -i\sigma_2;$	
	$\{R_5, R_6\};$	4; $\Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, -i\Gamma_{2,0};$	QCDP; 0
	$R_{11};$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_7, \sigma_8, -\sigma_0, -i\sigma_2;$	
	$\{R_{12}, R_{13}\};$	4; $\Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	QCDP; 0
$X; (0\frac{1}{2}0); \sigma_z, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$M; (\frac{1}{2}\frac{1}{2}0); \sigma_x, \sigma_z, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T};$	$R_4;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_7, \sigma_8, \sigma_0, -i\sigma_2;$	
	$\{R_5, R_6\};$	4; $\Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, -i\Gamma_{2,0};$	QCDP; 0
	$R_{11};$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, \sigma_7, \sigma_8, -\sigma_0, -i\sigma_2;$	
	$\{R_{12}, R_{13}\};$	4; $\Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	QCDP; 0
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	2; $i\sigma_2, i\sigma_1, -i\sigma_2;$	
$\Sigma; \Gamma M; \sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	2; $i\sigma_3, -i\sigma_2;$	
$\Lambda; \Gamma R; C_{31}^-, I\mathcal{T};$	$\{R_2, R_6\};$	2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$	
	$\{R_4, R_4\};$	2; $-\sigma_0, -i\sigma_2;$	
$S; XR; \sigma_y, \bar{E}, I\mathcal{T};$	$\{R_5, R_7\};$	2; $-i\sigma_3, -\sigma_0, -i\sigma_2;$	
$Z; XM; \sigma_y, C_{2x}, I\mathcal{T};$	$\{R_5, R_8\};$	2; $i\sigma_3, i\sigma_0, -i\sigma_2;$	
	$\{R_6, R_7\};$	2; $i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$T; MR; C_{2z}, \sigma_x, I\mathcal{T};$	$R_9;$	2; $i\sigma_3, -\sigma_1, -i\sigma_2;$	

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 $\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T};$	$R_4;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, \sigma_0, -i\sigma_2;$	
	$\{R_5, R_6\};$	$4; \Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, -i\Gamma_{2,0};$	QCDDP; 0
	$R_{11};$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, -\sigma_0, -i\sigma_2;$	
	$\{R_{12}, R_{13}\};$	$4; \Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	QCDDP; 0
$X; (\frac{1}{2}0\frac{1}{2}); C_{2x}, C_{2y}, I, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$L; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{61}^+, \bar{E}, \mathcal{T};$	$\{R_7, R_7\};$	$2; \sigma_0, -\sigma_0, -i\sigma_2;$	
	$\{R_8, R_{12}\};$	$2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -\sigma_0, -i\sigma_2;$	
	$\{R_9, R_{11}\};$	$2; \frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), -\sigma_0, -i\sigma_2;$	
	$\{R_{10}, R_{10}\};$	$2; -\sigma_0, -\sigma_0, -i\sigma_2;$	
$W; (\frac{1}{2}\frac{1}{4}\frac{3}{4}); C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$\Lambda; \Gamma L; C_{31}^-, I\mathcal{T};$	$\{R_2, R_6\};$	$2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$	
	$\{R_4, R_4\};$	$2; -\sigma_0, -i\sigma_2;$	
$\Sigma; \Gamma\Sigma; \sigma_z, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	
$S; X\Sigma; \sigma_y, I\mathcal{T};$	$\{R_2, R_4\};$	$2; i\sigma_3, -i\sigma_2;$	
$Z; XW; C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$Q; LW; \bar{E}, I\mathcal{T};$	$\{R_2, R_2\};$	$2; -\sigma_0, -i\sigma_2;$	

SG 203

 $\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \{I|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T}; R_4;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, \sigma_0, -i\sigma_2;$	
	$\{R_5, R_6\}; 4; \Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, -i\Gamma_{2,0};$	QCDDP; 0
	$R_{11}; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, -\sigma_0, -i\sigma_2;$	
	$\{R_{12}, R_{13}\}; 4; \Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	QCDDP; 0
$X; (\frac{1}{2}0\frac{1}{2}); \sigma_z, \sigma_y, I, \mathcal{T};$	$\{R_{13}, R_{14}\}; 4; \Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$L; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); S_{61}^+, \bar{E}, \mathcal{T};$	$\{R_7, R_7\}; 2; \sigma_0, -\sigma_0, -i\sigma_2;$	
	$\{R_8, R_{12}\}; 2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -\sigma_0, -i\sigma_2;$	
	$\{R_9, R_{11}\}; 2; \frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), -\sigma_0, -i\sigma_2;$	
	$\{R_{10}, R_{10}\}; 2; -\sigma_0, -\sigma_0, -i\sigma_2;$	
$W; (\frac{1}{2}\frac{1}{4}\frac{3}{4}); \sigma_z, C_{2x}, I, \mathcal{T};$	$\{R_{13}, R_{14}\}; 2; -(-1)^{3/4}\sigma_3, i\sigma_0, -i\sigma_2;$	
	$\{R_{17}, R_{18}\}; 2; -(-1)^{3/4}\sigma_3, -i\sigma_0, -i\sigma_2;$	
$\Delta; \Gamma X; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$\Lambda; \Gamma L; C_{31}^-, I, \mathcal{T};$	$\{R_2, R_6\}; 2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$	
	$\{R_4, R_4\}; 2; -\sigma_0, -i\sigma_2;$	
$\Sigma; \Gamma \Sigma; \sigma_z, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$	
$S; X S; \sigma_y, \bar{E}, I, \mathcal{T};$	$\{R_5, R_7\}; 2; -i\sigma_3, -\sigma_0, -i\sigma_2;$	
$Z; X W; \sigma_y, C_{2x}, I, \mathcal{T};$	$\{R_5, R_8\}; 2; i\sigma_3, i\sigma_0, -i\sigma_2;$	
	$\{R_6, R_7\}; 2; i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$Q; L W; \bar{E}, I, \mathcal{T};$	$\{R_2, R_2\}; 2; -\sigma_0, -i\sigma_2;$	

$\Gamma_c^v$ ;  $\{C_{31}^-|000\}$ ,  $\{C_{2x}|000\}$ ,  $\{\bar{C}_{2y}|000\}$ ,  $\{I|000\}$ ,  $\mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000); $C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T}$ ; $R_4$ ;	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, \sigma_0, -i\sigma_2$ ;	
	$\{R_5, R_6\}$ ; 4; $\Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, -i\Gamma_{2,0}$ ;	QCDDP; 0
	$R_{11}$ ; 2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, -\sigma_0, -i\sigma_2$ ;	
	$\{R_{12}, R_{13}\}$ ; 4; $\Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, -i\Gamma_{2,0}$ ;	QCDDP; 0
$H$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T}$ ; $R_4$ ;	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, \sigma_0, -i\sigma_2$ ;	
	$\{R_5, R_6\}$ ; 4; $\Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, -i\Gamma_{2,0}$ ;	QCDDP; 0
	$R_{11}$ ; 2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, -\sigma_0, -i\sigma_2$ ;	
	$\{R_{12}, R_{13}\}$ ; 4; $\Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, -i\Gamma_{2,0}$ ;	QCDDP; 0
$P$ ; $(\frac{1}{4}\frac{1}{4}\frac{1}{4})$ ; $C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T}$ ; $R_4$ ;	2; $-\sigma_6, -i\sigma_1, i\sigma_2, -i\sigma_2$ ;	
	$\{R_5, R_6\}$ ; 4; $\Gamma_{11}, -i\Gamma_{3,1}, i\Gamma_{0,2}, -i\Gamma_{2,0}$ ;	DP; 0
$N$ ; $(00\frac{1}{2})$ ; $C_{2z}, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, \sigma_0, -i\sigma_2$ ;	
	$\{R_6, R_8\}$ ; 2; $i\sigma_3, -\sigma_0, -i\sigma_2$ ;	
$\Sigma$ ; $\Gamma_N$ ; $\sigma_z, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$\Delta$ ; $\Gamma_H$ ; $C_{2y}, \sigma_x, I, \mathcal{T}$ ;	$R_5$ ; 2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	
$\Lambda$ ; $\Gamma_P$ ; $C_{31}^-, I, \mathcal{T}$ ;	$\{R_2, R_6\}$ ; 2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2$ ;	
	$\{R_4, R_4\}$ ; 2; $-\sigma_0, -i\sigma_2$ ;	
$D$ ; $\Gamma_P$ ; $C_{2z}, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$G$ ; $\Gamma_H$ ; $\sigma_z, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ; 2; $i\sigma_3, -i\sigma_2$ ;	
$F$ ; $\Gamma_H$ ; $C_{34}^+, I, \mathcal{T}$ ;	$\{R_2, R_6\}$ ; 2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2$ ;	
	$\{R_4, R_4\}$ ; 2; $-\sigma_0, -i\sigma_2$ ;	

$\Gamma_c; \{C_{31}^-|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\bar{C}_{2y}|0\frac{1}{2}\frac{1}{2}\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000);	$C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T}$ ; $R_4$ ;	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, \sigma_0, -i\sigma_2$ ;		
	$\{R_5, R_6\}$ ;	4; $\Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, -i\Gamma_{2,0}$ ;	QCDDP;	0
	$R_{11}$ ;	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, -\sigma_0, -i\sigma_2$ ;		
	$\{R_{12}, R_{13}\}$ ;	4; $\Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, -i\Gamma_{2,0}$ ;	QCDDP;	0
$X$ ; $(0\frac{1}{2}0)$ ;	$C_{2y}, C_{2z}, I, \mathcal{T}$ ;	$\{R_{13}, R_{14}\}$ ;	4; $\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ;	P-DNL <sub>XM</sub> ;
$M$ ; $(\frac{1}{2}\frac{1}{2}0)$ ;	$C_{2z}, C_{2x}, I, \mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4; $i\Gamma_{0,2}, \Gamma_{0,3}, \Gamma_{0,3}, i\Gamma_{2,0}$ ;	P-DNL <sub>XM</sub> ;
		$\{R_{10}, R_{10}\}$ ;	4; $i\Gamma_{0,2}, \Gamma_{0,3}, -\Gamma_{0,3}, i\Gamma_{2,0}$ ;	P-DNL <sub>XM</sub> ;
$R$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ;	$C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T}$ ;	$\{R_1, R_1\}$ ;	2; $\sigma_0, \sigma_0, \sigma_0, \sigma_0, -i\sigma_2$ ;	
		$\{R_2, R_3\}$ ;	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0, \sigma_0, \sigma_0, -i\sigma_2$ ;	
		$\{R_7, R_7\}$ ;	6; $-S_6, \frac{S_{0,0}+2\sqrt{3}S_{0,8}}{-3}, -iS_{11}, S_{0,0}, (-1)^{5/6}S_{2,0}$ ;	QCSP;
		$\{R_8, R_8\}$ ;	2; $\sigma_0, \sigma_0, \sigma_0, -\sigma_0, -i\sigma_2$ ;	
		$\{R_9, R_{10}\}$ ;	2; $\frac{1}{2}(-\sigma_0 + i\sqrt{3}\sigma_3), \sigma_0, \sigma_0, -\sigma_0, -i\sigma_2$ ;	
		$\{R_{14}, R_{14}\}$ ;	6; $-S_6, \frac{S_{0,0}+2\sqrt{3}S_{0,8}}{-3}, -iS_{11}, S_{0,0}, (-1)^{5/6}S_{2,0}$ ;	QCSP;
$\Delta$ ; $\Gamma X$ ;	$C_{2y}, \sigma_x, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	
$\Sigma$ ; $\Gamma M$ ;	$\sigma_z, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ;	
$\Lambda$ ; $\Gamma R$ ;	$C_{31}^-, I, \mathcal{T}$ ;	$\{R_2, R_6\}$ ;	2; $\frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2$ ;	
		$\{R_4, R_4\}$ ;	2; $-\sigma_0, -i\sigma_2$ ;	
$S$ ; $XR$ ;	$\sigma_y, \bar{E}, I, \mathcal{T}$ ;	$\{R_5, R_5\}$ ;	2; $-i\sigma_0, -\sigma_0, -i\sigma_2$ ;	
		$\{R_7, R_7\}$ ;	2; $i\sigma_0, -\sigma_0, -i\sigma_2$ ;	
$Z$ ; $XM$ ;	$\sigma_z, C_{2x}, I, \mathcal{T}$ ;	$\{R_9, R_9\}$ ;	4; $i\Gamma_{0,3}, -i\Gamma_{0,1}, -\Gamma_{2,1}$ ;	DNL;
$T$ ; $MR$ ;	$\sigma_x, \sigma_y, \bar{E}, I, \mathcal{T}$ ;	$\{R_6, R_6\}$ ;	2; $-\sigma_0, -i\sigma_0, -\sigma_0, -i\sigma_2$ ;	0
		$\{R_7, R_7\}$ ;	2; $-\sigma_0, i\sigma_0, -\sigma_0, -i\sigma_2$ ;	
		$\{R_8, R_8\}$ ;	2; $\sigma_0, -i\sigma_0, -\sigma_0, -i\sigma_2$ ;	
		$\{R_9, R_9\}$ ;	2; $\sigma_0, i\sigma_0, -\sigma_0, -i\sigma_2$ ;	
$Z'^b$ ; $X'M(\frac{1}{2}\alpha 0)$ ;	$\sigma_x, C_{2y}, I, \mathcal{T}$ ;	$\{R_5, R_6\}$ ;	2; $i\sigma_0, i\sigma_3, -i\sigma_2$ ;	
		$\{R_7, R_8\}$ ;	2; $-i\sigma_0, -i\sigma_3, -i\sigma_2$ ;	

<sup>b</sup>For the notation, see Table 6.15, Fig. 5.4 and the text of section 5.5 in Ref. [9].



$\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\bar{C}_{2y}|0\frac{1}{2}\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T}; R_4;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, \sigma_0, -i\sigma_2;$	
	$\{R_5, R_6\}; 4; \Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, -i\Gamma_{2,0};$	QC DP; 0
	$R_{11}; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, -\sigma_0, -i\sigma_2;$	
	$\{R_{12}, R_{13}\}; 4; \Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	QC DP; 0
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^-, \bar{C}_{2y}, \bar{C}_{2z}, I, \mathcal{T}; R_4;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, \sigma_0, -i\sigma_2;$	
	$\{R_5, R_6\}; 4; \Gamma_8, \Gamma_9, \Gamma_{10}, \Gamma_{0,0}, -i\Gamma_{2,0};$	QC DP; 0
	$R_{11}; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_3), \sigma_7, \sigma_8, -\sigma_0, -i\sigma_2;$	
	$\{R_{12}, R_{13}\}; 4; \Gamma_8, \Gamma_9, \Gamma_{10}, -\Gamma_{0,0}, -i\Gamma_{2,0};$	QC DP; 0
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{31}^-, C_{2x}, \bar{C}_{2y}, I, \mathcal{T}; \{R_1, R_1\};$	$2; \sigma_0, \sigma_0, \sigma_0, -i\sigma_2;$	
	$\{R_2, R_3\}; 2; \frac{-\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0, \sigma_0, -i\sigma_2;$	
	$\{R_7, R_7\}; 6; -S_6, \frac{S_{0,0} + 2\sqrt{3}S_{0,8}}{-3}, -iS_{11}, (-1)^{5/6}S_{2,0};$	SP; 0
$N; (00\frac{1}{2}); C_{2z}, E, I, \mathcal{T};$	$\{R_{10}, R_{10}\}; 4; i\Gamma_{0,2}, -\Gamma_{0,0}, \Gamma_{0,3}, i\Gamma_{2,0};$	DP; 0
$\Sigma; \Gamma_N; \sigma_z, I, \mathcal{T};$	$\{R_2, R_4\}; 2; i\sigma_3, -i\sigma_2;$	
$\Delta; \Gamma_H; C_{2y}, \sigma_x, I, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$\Lambda; \Gamma_P; C_{31}^-, I, \mathcal{T};$	$\{R_2, R_6\}; 2; \frac{1}{2}(\sigma_0 + i\sqrt{3}\sigma_3), -i\sigma_2;$	
	$\{R_4, R_4\}; 2; -\sigma_0, -i\sigma_2;$	
$D; \Gamma_P; C_{2z}, \bar{E}, I, \mathcal{T};$	$\{R_5, R_5\}; 2; -i\sigma_0, -\sigma_0, -i\sigma_2;$	
	$\{R_7, R_7\}; 2; i\sigma_0, -\sigma_0, -i\sigma_2;$	
$G; \Gamma_H; \sigma_z, I, \mathcal{T};$	$\{R_2, R_4\}; 2; \sigma_3, -i\sigma_2;$	
$F; \Gamma_H; C_{34}^+, \bar{E}, I, \mathcal{T};$	$\{R_7, R_7\}; 2; -i\sigma_0, -\sigma_0, -i\sigma_2;$	
	$\{R_9, R_{11}\}; 2; \frac{1}{2}(\sqrt{3}\sigma_3 + i\sigma_0), -\sigma_0, -i\sigma_2;$	

$\Gamma_c; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
		$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
		$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	C-4 DP; 4
$X; (0\frac{1}{2}0);$	$C_{4y}^+, C_{2z}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
		$R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$M; (\frac{1}{2}\frac{1}{2}0);$	$C_{4z}^+, C_{2x}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
		$R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
		$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
		$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	C-4 DP; 4
$\Delta; \Gamma X;$	$C_{4y}^+, \mathcal{T}C_{2z};$	$R_2; 1; \sqrt[4]{-1}, 1;$	
		$R_4; 1; (-1)^{3/4}, 1;$	
		$R_6; 1; -\sqrt[4]{-1}, 1;$	
		$R_8; 1; -(-1)^{3/4}, 1;$	
$\Sigma; \Gamma M;$	$C_{2a}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$	
		$R_4; 1; -i, 1;$	
$\Lambda; \Gamma R;$	$C_{31}^-, C_{2e}, \mathcal{T};$	$R_2; 1; \sqrt[3]{-1}, 1;$	
		$R_4; 1; -1, 1;$	
		$R_6; 1; -(-1)^{2/3}, 1;$	
$S; XR;$	$C_{2c}, \mathcal{T}C_{2y};$	$R_2; 1; i, 1;$	
		$R_4; 1; -i, 1;$	
$Z; XM;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$	
		$R_4; 1; -i, 1;$	
$T; MR;$	$C_{4z}^+, C_{2a}, \mathcal{T};$	$R_2; 1; \sqrt[4]{-1}, 1;$	
		$R_4; 1; (-1)^{3/4}, 1;$	
		$R_6; 1; -\sqrt[4]{-1}, 1;$	
		$R_8; 1; -(-1)^{3/4}, 1;$	

$\Gamma_c; \{C_{4x}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	C-4 DP; 4
$X; (0\frac{1}{2}0); C_{4y}^+, C_{2x}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2y}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	C-4 DP; 4
$\Delta; \Gamma X; C_{4y}^+, \mathcal{T}C_{2z};$	$R_2; 1; \sqrt[4]{-1}, 1;$	
	$R_4; 1; (-1)^{3/4}, 1;$	
	$R_6; 1; -\sqrt[4]{-1}, 1;$	
	$R_8; 1; -(-1)^{3/4}, 1;$	
$\Sigma; \Gamma M; C_{2a}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$\Lambda; \Gamma R; C_{31}^-, C_{2e}, \mathcal{T};$	$R_2; 1; \sqrt[3]{-1}, 1;$	
	$R_4; 1; -1, 1;$	
	$R_6; 1; -(-1)^{2/3}, 1;$	
$S; X R; C_{2c}, \bar{E}, \mathcal{T}C_{2y};$	$R_5; 1; -i, -1, 1;$	
	$R_7; 1; i, -1, 1;$	
$Z; X M; C_{2x}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$T; M R; C_{4z}^+, \bar{E}, C_{2a}, \mathcal{T};$	$R_2; 1; -\sqrt[4]{-1}, -1, 1;$	
	$R_4; 1; -(-1)^{3/4}, -1, 1;$	
	$R_6; 1; \sqrt[4]{-1}, -1, 1;$	
	$R_8; 1; (-1)^{3/4}, -1, 1;$	

$\Gamma_c^f$ ;  $\{C_{4x}^+|000\}$ ,  $\{\bar{C}_{31}^-|000\}$ ,  $\{C_{2b}|000\}$ ,  $\mathcal{T}$ ; Non-Centrosymmetric; with SOC

$\Gamma$ ; (000); $C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T}$ ; $R_4$ ;	2; $\frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2$ ; C-1 WP; 1
$R_5$ ;	2; $\frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2$ ; C-1 WP; 1
$R_8$ ;	4; $\Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0}$ ; C-4 DP; 4
$X$ ; $(\frac{1}{2}0\frac{1}{2})$ ; $C_{4y}^+, C_{2z}, \mathcal{T}$ ; $R_6$ ;	2; $\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$R_7$ ;	2; $-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ; C-1 WP; 1
$L$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $C_{31}^+, C_{2b}, \mathcal{T}$ ; $\{R_3, R_4\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ; C-3 WP; 3
$R_6$ ;	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2$ ; C-1 WP; 1
$W$ ; $(\frac{1}{2}\frac{1}{4}\frac{3}{4})$ ; $C_{2x}, C_{2d}, \mathcal{T}C_{2z}$ ; $R_5$ ;	2; $i\sigma_2, i\sigma_1, \frac{i(\sigma_1 - \sigma_3)}{\sqrt{2}}$ ; C-1 WP; 1
$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \mathcal{T}C_{2z}$ ; $R_2$ ;	1; $\sqrt[4]{-1}, 1$ ;
$R_4$ ;	1; $(-1)^{3/4}, 1$ ;
$R_6$ ;	1; $-\sqrt[4]{-1}, 1$ ;
$R_8$ ;	1; $-(-1)^{3/4}, 1$ ;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^-, C_{2e}, \mathcal{T}$ ; $R_2$ ;	1; $\sqrt[3]{-1}, 1$ ;
$R_4$ ;	1; $-1, 1$ ;
$R_6$ ;	1; $-(-1)^{2/3}, 1$ ;
$\Sigma$ ; $\Gamma\Sigma$ ; $C_{2a}, \mathcal{T}C_{2z}$ ; $R_2$ ;	1; $i, 1$ ;
$R_4$ ;	1; $-i, 1$ ;
$S$ ; $XS$ ; $C_{2c}, \mathcal{T}C_{2y}$ ; $R_2$ ;	1; $i, 1$ ;
$R_4$ ;	1; $-i, 1$ ;
$Z$ ; $XW$ ; $C_{2x}, \mathcal{T}C_{2z}$ ; $R_2$ ;	1; $i, 1$ ;
$R_4$ ;	1; $-i, 1$ ;
$Q$ ; $LW$ ; $C_{2f}$ ; $R_2$ ;	1; $i$ ;
$R_4$ ;	1; $-i$ ;

SG 210

 $\Gamma_c^f; \{C_{4x}^+ | \frac{1}{4} \frac{1}{4} \frac{1}{4}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{4} \frac{1}{4} \frac{1}{4}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T};$	$R_4;$	2; $\frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_5;$	2; $\frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_8;$	4; $\Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	C-4 DP; 4
$X; (\frac{1}{2} 0 \frac{1}{2}); C_{4y}^-, C_{2x}, \mathcal{T};$	$R_6;$	2; $\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
	$R_7;$	2; $-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$L; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{31}^+, C_{2b}, \mathcal{T};$	$\{R_3, R_4\};$	2; $-\sigma_0, i\sigma_3, -i\sigma_2;$	C-3 WP; 3
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	C-1 WP; 1
$W; (\frac{1}{2} \frac{1}{4} \frac{3}{4}); C_{2d}, C_{2x}, \mathcal{T}C_{2z};$	$\{R_1, R_3\};$	2; $\sigma_3, \sigma_0, \sigma_1;$	C-2 WP; 2
	$R_2;$	1; 1, -1, 1;	
	$R_4;$	1; -1, -1, 1;	
$\Delta; \Gamma X; C_{4y}^+, \mathcal{T}C_{2z};$	$R_2;$	1; $\sqrt[4]{-1}, 1;$	
	$R_4;$	1; $(-1)^{3/4}, 1;$	
	$R_6;$	1; $-\sqrt[4]{-1}, 1;$	
	$R_8;$	1; $-(-1)^{3/4}, 1;$	
	$R_{10};$	1; $\sqrt[4]{-1}, 1;$	
$\Lambda; \Gamma L; C_{31}^-, C_{2e}, \mathcal{T};$	$R_2;$	1; $\sqrt[3]{-1}, 1;$	
	$R_4;$	1; -1, 1;	
	$R_6;$	1; $-(-1)^{2/3}, 1;$	
$\Sigma; \Gamma \Sigma; C_{2a}, \mathcal{T}C_{2z};$	$R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	
$S; X S; C_{2c}, \bar{E}, \mathcal{T}C_{2y};$	$R_5;$	1; $-i, -1, 1;$	
	$R_7;$	1; $i, -1, 1;$	
$Z; X W; C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	1; $i, 1;$	
	$R_4;$	1; $-i, 1;$	
$Q; L W; C_{2f}, \bar{E};$	$R_{10};$	1; $-i, -1;$	
	$R_{14};$	1; $i, -1;$	

SG 211

 $\Gamma_c^v; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	C-4 DP; 4
$H; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	C-4 DP; 4
$P; (\frac{1}{4} \frac{1}{4} \frac{1}{4}); C_{31}^-, C_{2x}, \bar{C}_{2y}, C_{4y}^-, \mathcal{T};$	$R_4; 2; -\sigma_6, -i\sigma_1, i\sigma_2, -\frac{\sigma_0 + i\sigma_2}{\sqrt{2}};$	C-1 WP; 1
	$R_5; 2; (-1)^{5/3} \sigma_6, -i\sigma_1, i\sigma_2, \frac{\sigma_0 + i\sigma_2}{-\sqrt{2}};$	C-1 WP; 1
	$R_6; 2; \sqrt[3]{-1} \sigma_6, -i\sigma_1, i\sigma_2, \frac{\sigma_0 + i\sigma_2}{-\sqrt{2}};$	C-1 WP; 1
$N; (00 \frac{1}{2}); C_{2z}, C_{2b}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$\Sigma; \Gamma N; C_{2a}, \mathcal{T} C_{2z};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
	$R_6; 1; \sqrt[4]{-1}, 1;$	
$\Delta; \Gamma H; C_{4y}^+, \mathcal{T} C_{2z};$	$R_4; 1; (-1)^{3/4}, 1;$	
	$R_6; 1; -\sqrt[4]{-1}, 1;$	
	$R_8; 1; -(-1)^{3/4}, 1;$	
$\Lambda; \Gamma P; C_{31}^-, C_{2e}, \mathcal{T};$	$R_2; 1; \sqrt[3]{-1}, 1;$	
	$R_4; 1; -1, 1;$	
	$R_6; 1; -(-1)^{2/3}, 1;$	
$D; \Gamma P; C_{2z}, C_{2a}, \mathcal{T};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
	$R_6; 1; i, 1;$	
$G; \Gamma H; C_{2b}, \mathcal{T} C_{2z};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
	$R_6; 1; -1, 1;$	
$F; \Gamma H; C_{34}^+, C_{2a}, \mathcal{T};$	$R_2; 1; \sqrt[3]{-1}, 1;$	
	$R_4; 1; -1, 1;$	
	$R_6; 1; -(-1)^{2/3}, 1;$	

$\Gamma_c; \{C_{4x}^+ | \frac{3}{4} \frac{3}{4} \frac{1}{4} \frac{1}{4}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{4} \frac{1}{4} \frac{1}{4}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T};$	$R_4;$	$2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_5;$	$2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_8;$	$4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	C-4 DP; 4
$X; (0\frac{1}{2}0); C_{4y}^-, C_{2x}, \mathcal{T};$	$\{R_8, R_{10}\};$	$2; \sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>XMR</sub> ;
	$\{R_9, R_{11}\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>XMR</sub> ;
	$R_{14};$	$2; i\sigma_3, i\sigma_2, -i\sigma_2;$	P-NS <sub>XMR</sub> ;
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^-, C_{2x}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	C-2 DP; 2
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2x}, C_{2y}, C_{31}^-, C_{2b}, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, \sigma_0, -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NSs;
	$R_8;$	$2; -\sigma_0, \sigma_0, \frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-NSs;
	$\{R_{13}, R_{14}\};$	$6; iS_{11}, -S_7, S_{13}, S_{14}, -iS_{2,0};$	C-4 SP; 4
$\Delta; \Gamma X; C_{4y}^+, \mathcal{T}C_{2z};$	$R_2;$	$1; \sqrt[4]{-1}, 1;$	
	$R_4;$	$1; (-1)^{3/4}, 1;$	
	$R_6;$	$1; -\sqrt[4]{-1}, 1;$	
	$R_8;$	$1; -(-1)^{3/4}, 1;$	
$\Sigma; \Gamma M; C_{2a}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$\Lambda; \Gamma R; C_{31}^-, C_{2e}, \mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
	$R_4;$	$1; -1, 1;$	
	$R_6;$	$1; -(-1)^{2/3}, 1;$	
$S; XR; C_{2c}, \bar{E}, \mathcal{T}C_{2y};$	$\{R_{10}, R_{14}\};$	$2; -i\sigma_3, -\sigma_0, -i\sigma_2;$	L-NS <sub>XMR</sub> ;
$Z; XM; C_{2x}, \bar{E}, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>XMR</sub> ;
$T; MR; C_{4z}^+, \bar{E}, C_{2a}, \mathcal{T};$	$\{R_{10}, R_{14}\};$	$2; -\sqrt[4]{-1}\sigma_3, -\sigma_0, \sigma_1;$	L-NSs;
	$\{R_{12}, R_{16}\};$	$2; -(-1)^{3/4}\sigma_3, -\sigma_0, \sigma_1;$	L-NSs;

$\Gamma_c; \{C_{4x}^+ | \frac{1}{4} \frac{1}{4} \frac{3}{4}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{3}{4} \frac{3}{4} \frac{3}{4}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T};$	$R_4;$	$2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_5;$	$2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_8;$	$4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	C-4 DP; 4
$X; (0\frac{1}{2}0); C_{4y}^-, C_{2x}, \mathcal{T};$	$\{R_8, R_{10}\};$	$2; \sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>XMR</sub> ;
	$\{R_9, R_{11}\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NS <sub>XMR</sub> ;
	$R_{14};$	$2; i\sigma_3, i\sigma_2, -i\sigma_2;$	P-NS <sub>XMR</sub> ;
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^-, C_{2x}, \mathcal{T};$	$\{R_6, R_7\};$	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	C-2 DP; 2
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2x}, C_{2y}, C_{31}^-, C_{2b}, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, \sigma_0, -\sigma_0, i\sigma_3, -i\sigma_2;$	P-NSs;
	$R_8;$	$2; -\sigma_0, \sigma_0, \frac{\sigma_0 - i\sqrt{3}\sigma_3}{2}, i\sigma_1, -i\sigma_2;$	P-NSs;
	$\{R_{13}, R_{14}\};$	$6; iS_{11}, -S_7, S_{13}, S_{14}, -iS_{2,0};$	C-4 SP; 4
$\Delta; \Gamma X; C_{4y}^+, \mathcal{T}C_{2z};$	$R_2;$	$1; \sqrt[4]{-1}, 1;$	
	$R_4;$	$1; (-1)^{3/4}, 1;$	
	$R_6;$	$1; -\sqrt[4]{-1}, 1;$	
	$R_8;$	$1; -(-1)^{3/4}, 1;$	
$\Sigma; \Gamma M; C_{2a}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$	
	$R_4;$	$1; -i, 1;$	
$\Lambda; \Gamma R; C_{31}^-, C_{2e}, \mathcal{T};$	$R_2;$	$1; \sqrt[3]{-1}, 1;$	
	$R_4;$	$1; -1, 1;$	
	$R_6;$	$1; -(-1)^{2/3}, 1;$	
$S; XR; C_{2c}, \bar{E}, \mathcal{T}C_{2y};$	$\{R_{12}, R_{16}\};$	$2; i\sigma_3, -\sigma_0, -i\sigma_2;$	L-NS <sub>XMR</sub> ;
$Z; XM; C_{2x}, \bar{E}, \mathcal{T}C_{2z};$	$\{R_5, R_7\};$	$2; -i\sigma_3, -\sigma_0, \sigma_1;$	L-NS <sub>XMR</sub> ;
$T; MR; C_{4z}^+, \bar{E}, C_{2a}, \mathcal{T};$	$\{R_{10}, R_{14}\};$	$2; -\sqrt[4]{-1}\sigma_3, -\sigma_0, \sigma_1;$	L-NSs;
	$\{R_{12}, R_{16}\};$	$2; -(-1)^{3/4}\sigma_3, -\sigma_0, \sigma_1;$	L-NSs;



$\Gamma_c^v; \{C_{4x}^+|00\frac{1}{2}\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	C-4 DP; 4
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	C-1 WP; 1
	$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	C-4 DP; 4
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{31}^-, C_{2x}, \bar{C}_{2y}, C_{4y}^-, \mathcal{T};$	$R_1; 1; 1, 1, 1, 1;$	
	$R_2; 1; (-1)^{2/3}, 1, 1, 1;$	
	$R_3; 1; -\sqrt[3]{-1}, 1, 1, 1;$	
	$R_7; 3; A_9, -\frac{A_0}{3} - \frac{2A_8}{\sqrt{3}}, A_{10}, A_{23};$	C-2 TP;
	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$N; (00\frac{1}{2}); C_{2a}, C_{2b}, \mathcal{T};$		
	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	C-1 WP; 1
$\Sigma; \Gamma N; C_{2a}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$	
	$R_4; 1; -i, 1;$	
$\Delta; \Gamma H; C_{4y}^+, \mathcal{T}C_{2z};$	$R_2; 1; \sqrt[4]{-1}, 1;$	
	$R_4; 1; (-1)^{3/4}, 1;$	
	$R_6; 1; -\sqrt[4]{-1}, 1;$	
	$R_8; 1; -(-1)^{3/4}, 1;$	
	$R_2; 1; \sqrt[3]{-1}, 1;$	
$\Lambda; \Gamma P; C_{31}^-, C_{2e}, \mathcal{T};$	$R_4; 1; -1, 1;$	
	$R_6; 1; -(-1)^{2/3}, 1;$	
	$R_5; 1; -i, -1, 1;$	
$D; \Gamma P; C_{2z}, \bar{E}, C_{2a}, \mathcal{T};$	$R_7; 1; i, -1, 1;$	
	$R_5; 1; -i, -1, 1;$	
$G; \Gamma N; C_{2b}, \bar{E}, \mathcal{T}C_{2z};$	$R_7; 1; i, -1, 1;$	
	$R_5; 1; -i, -1, 1;$	
$F; \Gamma H; C_{34}^+, \bar{E}, C_{2a}, \mathcal{T};$	$R_7; 1; -i, -1, 1;$	
	$R_9; 1; \sqrt[6]{-1}, -1, 1;$	
	$R_{11}; 1; (-1)^{5/6}, -1, 1;$	

SG 215

 $\Gamma_c; \{S_{4x}^-|000\}, \{\bar{C}_{31}^-|000\}, \{\sigma_{db}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$S_{4x}^-, \bar{C}_{31}^-, \sigma_{db}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
		$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
		$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	DP;	0
$X; (0\frac{1}{2}0);$	$S_{4y}^+, C_{2z}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma X}$ ;	
		$R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma X}$ ;	
$M; (\frac{1}{2}\frac{1}{2}0);$	$S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6; 2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MR}$ ;	
		$R_7; 2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{MR}$ ;	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2});$	$S_{4x}^-, \bar{C}_{31}^-, \sigma_{db}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
		$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
		$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	DP;	0
$\Delta; \Gamma X;$	$C_{2y}, \sigma_{dc}, S_{4y}^+, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$
$\Sigma; \Gamma M;$	$\sigma_{db}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$		
		$R_4; 1; -i, 1;$		
$\Lambda; \Gamma R;$	$C_{31}^-, \sigma_{db};$	$R_3; 1; -1, i;$		
		$R_4; 1; -1, -i;$		
		$R_6; 2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$
$S; XR;$	$\sigma_{de}, \mathcal{T}\sigma_{dc};$	$R_2; 1; i, 1;$		
		$R_4; 1; -i, 1;$		
$Z; XM;$	$C_{2x}, \mathcal{T}C_{2z};$	$R_2; 1; i, 1;$		
		$R_4; 1; -i, 1;$		
$T; MR;$	$C_{2z}, \sigma_{da}, S_{4z}^+, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$

SG 216

 $\Gamma_c^f; \{S_{4x}^-|000\}, \{\bar{C}_{31}^-|000\}, \{\sigma_{db}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); S_{4x}^-, \bar{C}_{31}^-, \sigma_{db}, \mathcal{T};$	$R_4;$	$2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
	$R_5;$	$2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
	$R_8;$	$4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	DP;	0
$X; (\frac{1}{2}0\frac{1}{2}); S_{4y}^+, C_{2x}, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma X}$ ;	
	$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma X}$ ;	
$L; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^+, \sigma_{db}, \mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNLs;	
	$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2;$	P-WNL $_{\Gamma L}$ ;	
$W; (\frac{1}{2}\frac{1}{4}\frac{3}{4}); S_{4x}^+, \mathcal{T}C_{2z};$	$R_2;$	$1; \sqrt[4]{-1}, 1;$		
	$R_4;$	$1; (-1)^{3/4}, 1;$		
	$R_6;$	$1; -\sqrt[4]{-1}, 1;$		
	$R_8;$	$1; -(-1)^{3/4}, 1;$		
$\Delta; \Gamma X; C_{2y}, \sigma_{dc}, S_{4y}^+, \mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$
$\Lambda; \Gamma L; C_{31}^-, \sigma_{db};$	$R_3;$	$1; -1, i;$		
	$R_4;$	$1; -1, -i;$		
	$R_6;$	$2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma\Sigma; \sigma_{db}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$S; X\Sigma; \sigma_{de}, \mathcal{T}\sigma_{dc};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$Z; XW; C_{2x}, \mathcal{T}C_{2z};$	$R_2;$	$1; i, 1;$		
	$R_4;$	$1; -i, 1;$		
$Q; LW; \bar{E}, \mathcal{T}\sigma_{df};$	$R_2;$	$1; -1, 1;$		

SG 217

 $\Gamma_c^v; \{S_{4x}^-|000\}, \{\bar{C}_{31}^-|000\}, \{\sigma_{db}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000);$	$S_{4x}^-, \bar{C}_{31}^-, \sigma_{db}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
		$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
		$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	DP;	0
$H; (\frac{1}{2} \frac{1}{2} \frac{1}{2});$	$S_{4x}^-, \bar{C}_{31}^-, \sigma_{db}, \mathcal{T};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
		$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
		$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	DP;	0
$P; (\frac{1}{4} \frac{1}{4} \frac{1}{4});$	$S_{4x}^-, \bar{C}_{31}^-, \sigma_{db};$	$R_4; 2; \frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}};$	P-WNLs;	
		$R_5; 2; \frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}};$	P-WNLs;	
		$R_8; 4; \Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}};$	DP;	0
$N; (00 \frac{1}{2});$	$C_{2z}, \sigma_{db}, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -i\sigma_2;$	P-WNL <sub>NP</sub> ;	
$\Sigma; \Gamma N;$	$\sigma_{db}, \mathcal{T} C_{2z};$	$R_2; 1; i, 1;$		
		$R_4; 1; -i, 1;$		
$\Delta; \Gamma H;$	$C_{2y}, \sigma_{de}, S_{4y}^+, \mathcal{T};$	$R_5; 2; i\sigma_2, i\sigma_1, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$
$\Lambda; \Gamma P;$	$C_{31}^-, \sigma_{db};$	$R_3; 1; -1, i;$		
		$R_4; 1; -1, -i;$		
		$R_6; 2; \frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	WNL;	$\pi$
$D; \text{NP};$	$C_{2z}, \sigma_{db};$	$R_5; 2; i\sigma_2, i\sigma_1;$	WNL;	$\pi$
$G; \text{HN};$	$\sigma_{da}, \mathcal{T} C_{2z};$	$R_2; 1; i, 1;$		
		$R_4; 1; -i, 1;$		
$F; \text{PH};$	$C_{34}^+, \sigma_{da};$	$R_3; 1; -1, i;$		
		$R_4; 1; -1, -i;$		
		$R_6; 2; \frac{1}{2} (\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3;$	WNL;	$\pi$

SG 218

 $\Gamma_c; \{S_{4x}^- | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\bar{C}_{31}^- | 000\}, \{\sigma_{db} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

;						
$\Gamma; (000); S_{4x}^-, \bar{C}_{31}^-, \sigma_{db}, \mathcal{T};$	$R_4;$	2;	$\frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	P-WNLs;		
	$R_5;$	2;	$\frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	P-WNLs;		
	$R_8;$	4;	$\Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	DP;	0	
$X; (0\frac{1}{2}0); S_{4y}^+, \sigma_{dc}, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0	
$M; (\frac{1}{2}\frac{1}{2}0); S_{4z}^+, C_{2x}, \mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL <sub>MR</sub> ;		
	$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL <sub>MR</sub> ;		
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2x}, C_{2y}, C_{31}^-, \sigma_{db}, \mathcal{T};$	$\{R_6, R_7\};$	4;	$\Gamma_6, \Gamma_7, \frac{1}{2}(-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}), \Gamma_{0,1}, -i\Gamma_{2,0};$	DP;	0	
	$\{R_{15}, R_{15}\};$	8;	$\frac{(Q_{0,0,2} + Q_{0,3,3})}{i\sqrt{2}}, \frac{(Q_{0,0,2} - Q_{0,3,3})}{i\sqrt{2}}, Q_2, Q_{0,0,3}, -iQ_{2,1,0};$	OP;	0	
$\Delta; \Gamma X; C_{2y}, \sigma_{dc}, S_{4y}^+, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$	
$\Sigma; \Gamma M; \sigma_{db}, \mathcal{T} C_{2z};$	$R_2;$	1;	$i, 1;$			
	$R_4;$	1;	$-i, 1;$			
	$R_3;$	1;	$-1, i;$			
	$R_4;$	1;	$-1, -i;$			
$\Lambda; \Gamma R; C_{31}^-, \sigma_{db};$	$R_6;$	2;	$\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	WNL;	$\pi$	
	$\{R_2, R_4\};$	2;	$\sigma_3, -i\sigma_2;$	WNL;	$\pi$	
$S; XR; \sigma_{de}, \mathcal{T} \sigma_{dc};$	$\{R_2, R_4\};$	2;	$\sigma_3, -i\sigma_2;$	WNL;	$\pi$	
$Z; XM; C_{2x}, \mathcal{T} C_{2z};$	$R_2;$	1;	$i, 1;$			
	$R_4;$	1;	$-i, 1;$			
	$R_5;$	2;	$i\sigma_2, -i\sigma_1, -\frac{\sigma_0 + i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$	
$T; MR; C_{2z}, \sigma_{da}, S_{4z}^+, \mathcal{T};$	$R_5;$	2;	$i\sigma_2, -i\sigma_1, -\frac{\sigma_0 + i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$	

$\Gamma_c^f; \{S_{4x}^-|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\bar{C}_{31}^-|000\}, \{\sigma_{db}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$\Gamma; (000); S_{4x}^-, \bar{C}_{31}^-, \sigma_{db}, \mathcal{T}; R_4;$	2; $\frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
$R_5;$	2; $\frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
$R_8;$	4; $\Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	DP;	0
$X; (\frac{1}{2}0\frac{1}{2}); S_{4y}^+, C_{2x}, \mathcal{T}; R_6;$	2; $\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma X}$ ;	
$R_7;$	2; $-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	P-WNL $_{\Gamma X}$ ;	
$L; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{31}^+, \sigma_{db}, \mathcal{T}; \{R_1, R_1\};$	2; $\sigma_0, \sigma_0, -i\sigma_2;$	P-WNLs;	
$\{R_2, R_2\};$	2; $\sigma_0, -\sigma_0, -i\sigma_2;$	P-WNLs;	
$\{R_5, R_5\};$	4; $\frac{1}{2}(-\Gamma_{0,0} - i\sqrt{3}\Gamma_{0,2}), \Gamma_{0,3}, -i\Gamma_{2,0};$	DP;	0
$W; (\frac{1}{2}\frac{1}{2}\frac{3}{4}); S_{4x}^+, \mathcal{T}C_{2z}; \{R_2, R_6\};$	2; $\sqrt[4]{-1}\sigma_3, \sigma_1;$	P-WNLs;	
$\{R_4, R_8\};$	2; $(-1)^{3/4}\sigma_3, \sigma_1;$	P-WNLs;	
$\Delta; \Gamma X; C_{2y}, \sigma_{dc}, S_{4y}^+, \mathcal{T}; R_5;$	2; $i\sigma_2, i\sigma_1, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$
$\Lambda; \Gamma L; C_{31}^-, \sigma_{db}; R_3;$	1; $-1, i;$		
$R_4;$	1; $-1, -i;$		
$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	WNL;	$\pi$
$\Sigma; \Gamma\Sigma; \sigma_{db}, \mathcal{T}C_{2z}; R_2;$	1; $i, 1;$		
$R_4;$	1; $-i, 1;$		
$S; XS; \sigma_{de}, \mathcal{T}\sigma_{dc}; R_2;$	1; $-i, 1;$		
$R_4;$	1; $i, 1;$		
$Z; XW; C_{2x}, \mathcal{T}C_{2z}; R_2;$	1; $i, 1;$		
$R_4;$	1; $-i, 1;$		
$Q; LW; \bar{E}, \mathcal{T}\sigma_{df}; \{R_2, R_2\};$	2; $-\sigma_0, -i\sigma_2;$	WNL;	$\pi$

SG 220

 $\Gamma_c^v; \{S_{4x}^- | \frac{1}{2}00\}, \{\bar{C}_{31}^- | 000\}, \{\sigma_{db} | \frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$\Gamma; (000); S_{4x}^-, \bar{C}_{31}^-, \sigma_{db}, \mathcal{T};$	$R_4;$	2; $\frac{\sigma_0 - i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{-\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
	$R_5;$	2; $\frac{\sigma_0 - i\sigma_1}{-\sqrt{2}}, \sigma_6, \frac{i(\sigma_1 + \sigma_2)}{\sqrt{2}}, -i\sigma_2;$	P-WNLs;	
	$R_8;$	4; $\Gamma_4, \Gamma_5, \frac{i(\Gamma_{1,3} + \Gamma_{2,3})}{-\sqrt{2}}, -i\Gamma_{2,0};$	DP;	0
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{2x}, C_{2y}, C_{31}^-, \sigma_{db}, \mathcal{T};$	$\{R_6, R_7\};$	4; $\Gamma_6, \Gamma_7, \frac{1}{2}(-\Gamma_{0,0} - i\sqrt{3}\Gamma_{3,3}), \Gamma_{0,1}, -i\Gamma_{2,0};$	DP;	0
	$\{R_{15}, R_{15}\};$	8; $\frac{(Q_{0,0,2} + Q_{0,3,3})}{i\sqrt{2}}, \frac{(Q_{0,0,2} - Q_{0,3,3})}{i\sqrt{2}}, Q_2, Q_{0,0,3}, -iQ_{2,1,0};$	OP;	0
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{32}^+, C_{2y}, C_{2x}, S_{4x}^+;$	$R_{17};$	1; $-i, i, i, -\sqrt[4]{-1};$		
	$R_{18};$	1; $-i, i, i, \sqrt[4]{-1};$		
	$R_{21};$	2; $\frac{1}{2}(\sqrt{3}\sigma_3 + i\sigma_0), i\sigma_0, i\sigma_0, \sqrt[4]{-1}\sigma_1;$	P-WNLs;	
	$R_{27};$	3; $-iA_9, -\frac{i(A_0 + 2\sqrt{3}A_8)}{3}, iA_{10}, -\frac{(1+i)A_{18}}{\sqrt{2}};$	TP;	0
	$R_{28};$	3; $-iA_9, -\frac{i(A_0 + 2\sqrt{3}A_8)}{3}, iA_{10}, \sqrt[4]{-1}A_{18};$	TP;	0
$N; (00\frac{1}{2}); \sigma_{db}, C_{2z}, \mathcal{T};$	$\{R_5, R_6\};$	2; $-\sigma_0, i\sigma_3, -i\sigma_2;$	P-WNL;	
	$\{R_7, R_8\};$	2; $\sigma_0, -i\sigma_3, -i\sigma_2;$	P-WNL;	
$\Sigma; \Gamma N; \sigma_{db}, \mathcal{T}C_{2z};$	$R_2;$	1; $i, 1;$		
	$R_4;$	1; $-i, 1;$		
$\Delta; \Gamma H; C_{2y}, \sigma_{de}, S_{4y}^+, \mathcal{T};$	$R_5;$	2; $i\sigma_2, i\sigma_1, -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}};$	WNL;	$\pi$
$\Lambda; \Gamma P; C_{31}^-, \sigma_{db};$	$R_3;$	1; $-1, i;$		
	$R_4;$	1; $-1, -i;$		
	$R_6;$	2; $\frac{\sigma_0 - i\sqrt{3}\sigma_2}{2}, i\sigma_3;$	WNL;	$\pi$
	$R_8;$	1; $-i, 1;$		
$D; NP; C_{2z}, \sigma_{db};$	$R_5;$	1; $i, 1;$		
	$R_6;$	1; $i, -1;$		
	$R_7;$	1; $-i, -1;$		
	$R_8;$	1; $-i, 1;$		
	$\{R_2, R_4\};$	2; $i\sigma_3, \sigma_1;$	WNL;	$\pi$
$G; HN; \sigma_{db}, \mathcal{T}C_{2z};$	$R_9;$	1; $-i, \sqrt[4]{-1}, 1;$		
$F; PH; C_{34}^+, \sigma_{da}, E;$	$R_{10};$	1; $-i, -\sqrt[4]{-1}, 1;$		
	$R_{12};$	2; $\frac{1}{2}(\sqrt{3}\sigma_2 + i\sigma_0), \sqrt[4]{-1}\sigma_3, \sigma_0;$	WNL;	$\pi$

SG 221

 $\Gamma_c; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T};$	$R_4;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2;$	
	$R_5;$	$2; -\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2;$	
	$R_8;$	$4; \frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2};$	QCDP; 0
	$R_{12};$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2;$	
	$R_{13};$	$2; -\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2;$	
	$R_{16};$	$4; \frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2};$	QCDP; 0
$X; (0\frac{1}{2}0); C_{4y}^+, C_{2z}, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_{13};$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
	$R_{14};$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^+, C_{2x}, I, \mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
	$R_{13};$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
	$R_{14};$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T};$	$R_4;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2;$	
	$R_5;$	$2; -\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2;$	
	$R_8;$	$4; \frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2};$	QCDP; 0
	$R_{12};$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2;$	
	$R_{13};$	$2; -\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2;$	
	$R_{16};$	$4; \frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2};$	QCDP; 0
$\Delta; \Gamma X; C_{4y}^+, \sigma_x, I\mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$\Lambda; \Gamma R; C_{31}^-, \sigma_{db}, I\mathcal{T};$	$\{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	
	$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
$S; XR; C_{2c}, \sigma_y, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$Z; XM; C_{2x}, \sigma_z, I\mathcal{T};$	$R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$T; MR; C_{4z}^+, \sigma_y, I\mathcal{T};$	$R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
	$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	



$\Gamma_c; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T};$	$R_4;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2;$	
	$R_5;$	2;	$-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2;$	
	$R_8;$	4;	$\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2};$	QCDDP; 0
	$R_{12};$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2;$	
	$R_{13};$	2;	$-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2;$	
	$R_{16};$	4;	$\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2};$	QCDDP; 0
$X; (0\frac{1}{2}0); I, \sigma_x, C_{4y}^-, \mathcal{T};$	$\{R_{19}, R_{20}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, \frac{\Gamma_{0,0}+i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$	DP; 0
	$\{R_{21}, R_{22}\};$	4;	$\Gamma_{3,2}, \Gamma_{0,3}, -\frac{\Gamma_{0,0}+i\Gamma_{0,2}}{\sqrt{2}}, -i\Gamma_{2,0};$	DP; 0
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^-, \sigma_x, C_{2x}, \mathcal{T};$	$R_{19};$	4;	$-\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	DP; 0
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^-, C_{2x}, \bar{C}_{31}^-, I, \mathcal{T};$	$R_{18};$	4;	$\frac{\Gamma_{3,0}-i\Gamma_{3,3}}{\sqrt{2}}, i\Gamma_{0,1}, \Gamma_3, i\Gamma_{2,0}, -i\Gamma_{0,2};$	DP; 0
	$\{R_{21}, R_{22}\};$	8;	$\frac{Q_{0,1,0}-iQ_{3,1,3}}{\sqrt{2}}, iQ_{3,0,1}, Q_1, Q_{0,3,0}, -iQ_{2,0,0};$	OP; 0
$\Delta; \Gamma X; C_{4y}^+, \sigma_x, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
	$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$\Lambda; \Gamma R; C_{31}^-, \sigma_{db}, I\mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	
	$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
$S; XR; \sigma_y, C_{2c}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$	
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$Z; XM; \sigma_y, C_{2x}, I\mathcal{T};$	$\{R_5, R_8\};$	2;	$i\sigma_3, i\sigma_0, -i\sigma_2;$	
	$\{R_6, R_7\};$	2;	$i\sigma_3, -i\sigma_0, -i\sigma_2;$	
$T; MR; C_{4z}^-, \sigma_x, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_1+i\sigma_0}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$	
	$R_7;$	2;	$\frac{\sigma_1-i\sigma_0}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$	

$\Gamma_c; \{C_{4x}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T}; R_4;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2;$	
$R_5;$	2;	$-\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2;$	
$R_8;$	4;	$\frac{\Gamma_{3,0} + i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2};$	QCDP; 0
$R_{12};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2;$	
$R_{13};$	2;	$-\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2;$	
$R_{16};$	4;	$\frac{\Gamma_{3,0} + i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2};$	QCDP; 0
$X; (0 \frac{1}{2} 0); C_{4y}^+, \sigma_{de}, C_{2e}, \mathcal{T}; R_{19};$	4;	$-\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$	DP; 0
$M; (\frac{1}{2} \frac{1}{2} 0); C_{4z}^+, C_{2y}, I, \mathcal{T}; R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
$R_{13};$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$R_{14};$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$R; (\frac{1}{2} \frac{1}{2} \frac{1}{2}); C_{4z}^-, C_{2x}, \bar{C}_{31}^-, I, \mathcal{T}; R_{18};$	4;	$\frac{\Gamma_{3,0} - i\Gamma_{3,3}}{\sqrt{2}}, i\Gamma_{0,1}, \Gamma_3, i\Gamma_{2,0}, -i\Gamma_{0,2};$	DP; 0
$\{R_{21}, R_{22}\};$	8;	$\frac{Q_{0,1,0} - iQ_{3,1,3}}{\sqrt{2}}, iQ_{3,0,1}, Q_1, Q_{0,3,0}, -iQ_{2,0,0};$	OP; 0
$\Delta; \Gamma X; C_{4y}^+, \sigma_x, I\mathcal{T}; R_6;$	2;	$\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$R_7;$	2;	$-\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T}; R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$\Lambda; \Gamma R; C_{31}^-, \sigma_{db}, I\mathcal{T}; \{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	
$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
$S; XR; C_{2c}, \sigma_y, I\mathcal{T}; \{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$	
$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$	
$Z; XM; C_{2x}, \sigma_z, I\mathcal{T}; R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$T; MR; C_{4z}^+, \sigma_x, E, I\mathcal{T}; R_{13};$	2;	$-\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	
$R_{14};$	2;	$\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2;$	

$\Gamma_c; \{C_{4x}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T}; R_4;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2;$
$R_5;$	$2; -\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2;$
$R_8;$	$4; \frac{\Gamma_{3,0} + i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2};$ QCDDP; 0
$R_{12};$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2;$
$R_{13};$	$2; -\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2;$
$R_{16};$	$4; \frac{\Gamma_{3,0} + i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2};$ QCDDP; 0
$X; (0\frac{1}{2}0); C_{4y}^+, \sigma_x, C_{2x}, \mathcal{T}; R_{19};$	$4; -\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$M; (\frac{1}{2}\frac{1}{2}0); C_{4z}^-, \sigma_x, C_{2x}, \mathcal{T}; R_{19};$	$4; -\frac{\Gamma_{3,0} - i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2};$ DP; 0
$R; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T}; R_4;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2;$
$R_5;$	$2; -\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2;$
$R_8;$	$4; \frac{\Gamma_{3,0} + i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2};$ QCDDP; 0
$R_{12};$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2;$
$R_{13};$	$2; -\frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2;$
$R_{16};$	$4; \frac{\Gamma_{3,0} + i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2};$ QCDDP; 0
$\Delta; \Gamma X; C_{4y}^+, \sigma_x, I\mathcal{T}; R_6;$	$2; \frac{\sigma_0 + i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$R_7;$	$2; -\frac{\sigma_0 - i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$
$\Sigma; \Gamma M; C_{2a}, \sigma_z, I\mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$
$\Lambda; \Gamma R; C_{31}^-, \sigma_{db}, I\mathcal{T}; \{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$
$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$
$S; X R; \sigma_{de}, C_{2c}, I\mathcal{T}; R_9;$	$2; i\sigma_3, -i\sigma_1, -i\sigma_2;$
$Z; X M; \sigma_y, C_{2x}, I\mathcal{T}; \{R_5, R_8\};$	$2; i\sigma_3, i\sigma_0, -i\sigma_2;$
$\{R_6, R_7\};$	$2; i\sigma_3, -i\sigma_0, -i\sigma_2;$
$T; M R; C_{4z}^-, \sigma_y, I\mathcal{T}; R_6;$	$2; \frac{-\sigma_1 - i\sigma_0}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$
$R_7;$	$2; \frac{i(\sigma_0 + i\sigma_1)}{\sqrt{2}}, -\sigma_3, -i\sigma_2;$

$\Gamma_c^f$ ;  $\{C_{4x}^+|000\}$ ,  $\{\bar{C}_{31}^-|000\}$ ,  $\{C_{2b}|000\}$ ,  $\{I|000\}$ ,  $\mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000); $C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T}$ ; $R_4$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2$ ;	
$R_5$ ;	2; $-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2$ ;	
$R_8$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2}$ ;	QCDP; 0
$R_{12}$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2$ ;	
$R_{13}$ ;	2; $-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2$ ;	
$R_{16}$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ;	QCDP; 0
$X$ ; $(\frac{1}{2}0\frac{1}{2})$ ; $C_{4y}^+, C_{2x}, I, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2$ ;
	$R_7$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2$ ;
	$R_{13}$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2$ ;
	$R_{14}$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2$ ;
$L$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $C_{31}^-, C_{2b}, I, \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2; $-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2$ ;
	$R_6$ ;	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, \sigma_0, -i\sigma_2$ ;
	$\{R_9, R_{10}\}$ ;	2; $-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2$ ;
	$R_{12}$ ;	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -\sigma_0, -i\sigma_2$ ;
$W$ ; $(\frac{1}{2}\frac{1}{4}\frac{3}{4})$ ; $S_{4x}^+, C_{2d}, I, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;
	$R_7$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;
$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, I, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;
	$R_7$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^-, \sigma_{db}, I, \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;
	$R_6$ ;	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2$ ;
$\Sigma$ ; $\Gamma\Sigma$ ; $C_{2a}, \sigma_z, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$S$ ; $XS$ ; $C_{2c}, \sigma_y, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$Z$ ; $XW$ ; $C_{2x}, \sigma_z, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$Q$ ; $LW$ ; $C_{2f}, I, \mathcal{T}$ ;	$\{R_2, R_4\}$ ;	2; $i\sigma_3, -i\sigma_2$ ;

$\Gamma_c^f$ ;  $\{C_{4x}^+|000\}$ ,  $\{\bar{C}_{31}^-|000\}$ ,  $\{C_{2b}|000\}$ ,  $\{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}$ ,  $\mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000); $C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T}$ ; $R_4$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2$ ;	
$R_5$ ;	2; $-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2$ ;	
$R_8$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2}$ ;	QCDP; 0
$R_{12}$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2$ ;	
$R_{13}$ ;	2; $-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2$ ;	
$R_{16}$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ;	QCDP; 0
$X$ ; $(\frac{1}{2}0\frac{1}{2})$ ; $C_{4y}^+, C_{2x}, I, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2$ ;
	$R_7$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, \sigma_0, -i\sigma_2$ ;
	$R_{13}$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2$ ;
	$R_{14}$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -\sigma_0, -i\sigma_2$ ;
$L$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $\bar{C}_{31}^+, C_{2b}, I, \mathcal{T}$ ;	$\{R_{10}, R_{10}\}$ ;	4; $-\Gamma_{0,0}, i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1}$ ; CDP; 0
	$\{R_{17}, R_{18}\}$ ;	4; $\frac{\Gamma_{0,0}-i\sqrt{3}\Gamma_{3,3}}{2}, i\Gamma_{3,1}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ; DP; 0
$W$ ; $(\frac{1}{2}\frac{1}{4}\frac{3}{4})$ ; $S_{4x}^-, C_{2f}, I, \mathcal{T}$ ;	$\{R_6, R_7\}$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{3,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{2,0}$ ; DP; 0
$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, I, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;
	$R_7$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^-, \sigma_{db}, I, \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;
	$R_6$ ;	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2$ ;
$\Sigma$ ; $\Gamma \Sigma$ ; $C_{2a}, \sigma_z, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$S$ ; $X S$ ; $C_{2c}, \sigma_y, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, -i\sigma_1, -i\sigma_2$ ;
$Z$ ; $X W$ ; $C_{2x}, \sigma_z, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, -i\sigma_1, -i\sigma_2$ ;
$Q$ ; $L W$ ; $C_{2f}, I, \mathcal{T}$ ;	$\{R_2, R_2\}$ ;	2; $i\sigma_0, -i\sigma_2$ ;
	$\{R_4, R_4\}$ ;	2; $-i\sigma_0, -i\sigma_2$ ;

$\Gamma_c^f$ ;  $\{C_{4x}^+|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}$ ,  $\{\bar{C}_{31}^-|000\}$ ,  $\{C_{2b}|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}$ ,  $\{I|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}$ ,  $\mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000); $C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T}$ ; $R_4$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2$ ;
$R_5$ ;	2; $-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2$ ;
$R_8$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; QCDP; 0
$R_{12}$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2$ ;
$R_{13}$ ;	2; $-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2$ ;
$R_{16}$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; QCDP; 0
$X$ ; $(\frac{1}{2}0\frac{1}{2})$ ; $C_{4y}^+, \sigma_x, C_{2x}, \mathcal{T}$ ;	$R_{19}$ ;
$L$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $\bar{C}_{31}^-, C_{2b}, I, \mathcal{T}$ ;	$\{R_3, R_4\}$ ; 2; $-\sigma_0, i\sigma_3, \sigma_0, -i\sigma_2$ ;
	$R_6$ ;
	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, \sigma_0, -i\sigma_2$ ;
	$\{R_9, R_{10}\}$ ; 2; $-\sigma_0, i\sigma_3, -\sigma_0, -i\sigma_2$ ;
	$R_{12}$ ;
	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -\sigma_0, -i\sigma_2$ ;
$W$ ; $(\frac{1}{2}\frac{1}{2}\frac{3}{4})$ ; $S_{4x}^-, \sigma_y, I\mathcal{T}$ ;	$\{R_{13}, R_{14}\}$ ; 2; $\sqrt[4]{-1}\sigma_0, \sqrt[4]{-1}\sigma_3, -i\sigma_2$ ;
	$\{R_{15}, R_{16}\}$ ; 2; $-\sqrt[4]{-1}\sigma_0, \sqrt[4]{-1}\sigma_3, -i\sigma_2$ ;
	$R_{20}$ ;
	2; $(-1)^{3/4}\sigma_2, \sqrt[4]{-1}\sigma_3, -i\sigma_2$ ;
$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, I\mathcal{T}$ ;	$R_6$ ;
	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;
	$R_7$ ;
	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;
$\Lambda$ ; $\Gamma L$ ; $C_{31}^-, \sigma_{db}, I\mathcal{T}$ ;	$\{R_3, R_4\}$ ; 2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;
	$R_6$ ;
	2; $\frac{\sigma_0-i\sqrt{3}\sigma_2}{2}, i\sigma_3, -i\sigma_2$ ;
$\Sigma$ ; $\Gamma\Sigma$ ; $C_{2a}, \sigma_z, I\mathcal{T}$ ;	$R_5$ ;
	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;
$S$ ; $XS$ ; $\sigma_{de}, \sigma_y, I\mathcal{T}$ ;	$R_9$ ;
	2; $i\sigma_3, -i\sigma_1, -i\sigma_2$ ;
$Z$ ; $XW$ ; $\sigma_y, \sigma_z, I\mathcal{T}$ ;	$\{R_5, R_7\}$ ; 2; $i\sigma_3, \sigma_3, -i\sigma_2$ ;
	$\{R_6, R_8\}$ ; 2; $i\sigma_3, -\sigma_3, -i\sigma_2$ ;
$Q$ ; $LW$ ; $C_{2f}, \bar{E}, I\mathcal{T}$ ;	$\{R_{10}, R_{14}\}$ ; 2; $-i\sigma_3, -\sigma_0, -i\sigma_2$ ;

$\Gamma_c^f$ ;  $\{C_{4x}^+|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}$ ,  $\{\bar{C}_{31}^-|000\}$ ,  $\{C_{2b}|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}$ ,  $\{I|\frac{3}{4}\frac{3}{4}\frac{3}{4}\}$ ,  $\mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma$ ; (000); $C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T}$ ; $R_4$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2$ ;		
$R_5$ ;	2; $-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2$ ;		
$R_8$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2}$ ;	QCDP; 0	
$R_{12}$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2$ ;		
$R_{13}$ ;	2; $-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2$ ;		
$R_{16}$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ;	QCDP; 0	
$X$ ; $(\frac{1}{2}0\frac{1}{2})$ ; $C_{4y}^+, \sigma_x, C_{2x}, \mathcal{T}$ ;	$R_{19}$ ;	4; $-\frac{\Gamma_{3,0}-i\Gamma_{3,1}}{\sqrt{2}}, \Gamma_{1,2}, i\Gamma_{0,3}, -i\Gamma_{3,2}$ ;	DP; 0
$L$ ; $(\frac{1}{2}\frac{1}{2}\frac{1}{2})$ ; $\bar{C}_{31}^+, C_{2b}, I, \mathcal{T}$ ;	$\{R_{10}, R_{10}\}$ ;	4; $-\Gamma_{0,0}, i\Gamma_{0,3}, \Gamma_{0,1}, -\Gamma_{2,1}$ ;	CDP; 0
	$\{R_{17}, R_{18}\}$ ;	4; $\frac{\Gamma_{0,0}-i\sqrt{3}\Gamma_{3,3}}{2}, i\Gamma_{3,1}, \Gamma_{0,3}, -i\Gamma_{2,0}$ ;	DP; 0
$W$ ; $(\frac{1}{2}\frac{1}{4}\frac{3}{4})$ ; $S_{4x}^+, \sigma_z, I, \mathcal{T}$ ;	$\{R_{13}, R_{16}\}$ ;	2; $\sqrt[4]{-1}\sigma_3, \sqrt[4]{-1}\sigma_3, -i\sigma_2$ ;	
	$\{R_{14}, R_{15}\}$ ;	2; $\sqrt[4]{-1}\sigma_3, -\sqrt[4]{-1}\sigma_3, -i\sigma_2$ ;	
	$\{R_{20}, R_{20}\}$ ;	4; $(-1)^{3/4}\Gamma_{0,2}, \sqrt[4]{-1}\Gamma_{0,3}, -\Gamma_{2,1}$ ;	QDP; 0
$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \sigma_x, I, \mathcal{T}$ ;	$R_6$ ;	2; $\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	
	$R_7$ ;	2; $-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2$ ;	
$\Lambda$ ; $\Gamma L$ ; $C_{31}^-, \sigma_{db}, I, \mathcal{T}$ ;	$\{R_3, R_4\}$ ;	2; $-\sigma_0, i\sigma_3, -i\sigma_2$ ;	
	$R_6$ ;	2; $\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2$ ;	
$\Sigma$ ; $\Gamma\Sigma$ ; $C_{2a}, \sigma_z, I, \mathcal{T}$ ;	$R_5$ ;	2; $i\sigma_2, i\sigma_1, -i\sigma_2$ ;	
$S$ ; $XS$ ; $\sigma_{de}, \sigma_y, I, \mathcal{T}$ ;	$R_9$ ;	2; $-i\sigma_3, i\sigma_1, -i\sigma_2$ ;	
$Z$ ; $XW$ ; $\sigma_y, \sigma_z, I, \mathcal{T}$ ;	$\{R_5, R_7\}$ ;	2; $-i\sigma_3, -\sigma_3, -i\sigma_2$ ;	
	$\{R_6, R_8\}$ ;	2; $-i\sigma_3, \sigma_3, -i\sigma_2$ ;	
$Q$ ; $LW$ ; $C_{2f}, \bar{E}, I, \mathcal{T}$ ;	$\{R_{10}, R_{10}\}$ ;	2; $-i\sigma_0, -\sigma_0, -i\sigma_2$ ;	
	$\{R_{14}, R_{14}\}$ ;	2; $i\sigma_0, -\sigma_0, -i\sigma_2$ ;	

$\Gamma_c^v; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T}; R_4;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2;$	
$R_5;$	$2; -\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2;$	
$R_8;$	$4; \frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2};$	QCDP; 0
$R_{12};$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2;$	
$R_{13};$	$2; -\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2;$	
$R_{16};$	$4; \frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2};$	QCDP; 0
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T}; R_4;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2;$	
$R_5;$	$2; -\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2;$	
$R_8;$	$4; \frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2};$	QCDP; 0
$R_{12};$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2;$	
$R_{13};$	$2; -\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2;$	
$R_{16};$	$4; \frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2};$	QCDP; 0
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); S_{4x}^-, \bar{C}_{31}^-, \sigma_{db}, I\mathcal{T}; R_4;$	$2; \frac{\sigma_0-i\sigma_1}{\sqrt{2}}, \sigma_6, -\frac{i(\sigma_1+\sigma_2)}{\sqrt{2}}, -i\sigma_2;$	
$R_5;$	$2; -\frac{\sigma_0-i\sigma_1}{\sqrt{2}}, \sigma_6, \frac{i(\sigma_1+\sigma_2)}{\sqrt{2}}, -i\sigma_2;$	
$R_8;$	$4; \Gamma_4, \Gamma_5, -\frac{i(\Gamma_{1,3}+\Gamma_{2,3})}{\sqrt{2}}, -i\Gamma_{2,0};$	DP; 0
$N; (00\frac{1}{2}); C_{2a}, C_{2b}, I, \mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, \sigma_0, -i\sigma_2;$	
$R_{10};$	$2; i\sigma_2, i\sigma_1, -\sigma_0, -i\sigma_2;$	
$\Sigma; \Gamma N; C_{2a}, \sigma_z, I\mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$\Delta; \Gamma H; C_{4y}^+, \sigma_x, I\mathcal{T}; R_6;$	$2; \frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$R_7;$	$2; -\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$\Lambda; \Gamma P; C_{31}^-, \sigma_{db}, I\mathcal{T}; \{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	
$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
$D; \Gamma P; C_{2z}, \sigma_{db}, I\mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$G; \Gamma H; C_{2b}, \sigma_{da}, I\mathcal{T}; R_5;$	$2; i\sigma_2, i\sigma_1, -i\sigma_2;$	
$F; \Gamma H; C_{34}^+, \sigma_{da}, I\mathcal{T}; \{R_3, R_4\};$	$2; -\sigma_0, i\sigma_3, -i\sigma_2;$	
$R_6;$	$2; \frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	



$\Gamma_c^v; \{C_{4x}^+|00\frac{1}{2}\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$\Gamma; (000); C_{4x}^+, \bar{C}_{31}^-, C_{2b}, I, \mathcal{T};$	$R_4;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, \sigma_0, -i\sigma_2;$	
	$R_5;$	2;	$-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, \sigma_0, -i\sigma_2;$	
	$R_8;$	4;	$\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, \Gamma_{0,0}, -i\Gamma_{0,2};$	QC DP; 0
	$R_{12};$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, \sigma_5, -\sigma_0, -i\sigma_2;$	
	$R_{13};$	2;	$-\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, \sigma_4, -\sigma_5, -\sigma_0, -i\sigma_2;$	
	$R_{16};$	4;	$\frac{\Gamma_{3,0}+i\Gamma_{0,1}}{\sqrt{2}}, \Gamma_1, \Gamma_2, -\Gamma_{0,0}, -i\Gamma_{0,2};$	QC DP; 0
$H; (\frac{1}{2}\frac{1}{2}\frac{1}{2}); C_{4z}^+, C_{2y}, \bar{C}_{31}^+, I, \mathcal{T};$	$R_{18};$	4;	$\frac{\Gamma_{3,0}-i\Gamma_{3,3}}{\sqrt{2}}, i\Gamma_{0,1}, \Gamma_3, i\Gamma_{2,0}, -i\Gamma_{0,2};$	DP; 0
	$\{R_{21}, R_{22}\};$	8;	$\frac{Q_{0,1,0}-iQ_{3,1,3}}{\sqrt{2}}, iQ_{3,0,1}, Q_1, Q_{0,3,0}, -iQ_{2,0,0};$	OP; 0
$P; (\frac{1}{4}\frac{1}{4}\frac{1}{4}); C_{32}^+, C_{2y}, C_{2x}, S_{4x}^+, I\mathcal{T};$	$\{R_{17}, R_{18}\};$	2;	$-i\sigma_0, i\sigma_0, i\sigma_0, -\sqrt[4]{-1}\sigma_3, -i\sigma_2;$	
	$R_{21};$	2;	$\frac{\sqrt{3}\sigma_3+i\sigma_0}{2}, i\sigma_0, i\sigma_0, (-1)^{\frac{1}{4}}\sigma_1, -i\sigma_2;$	
	$\{R_{27}, R_{28}\};$	6;	$iS_6, \frac{S_{0,0}+2\sqrt{3}S_{0,8}}{3i}, S_{11}, S_{12}, -iS_{2,0};$	SP; 0
$N; (00\frac{1}{2}); \sigma_{db}, \sigma_{da}, I, \mathcal{T};$	$\{R_{13}, R_{14}\};$	4;	$\Gamma_{0,1}, i\Gamma_{3,0}, \Gamma_{0,3}, -i\Gamma_{2,0};$	DP; 0
$\Sigma; \Gamma N; C_{2a}, \sigma_z, I\mathcal{T};$	$R_5;$	2;	$i\sigma_2, i\sigma_1, -i\sigma_2;$	
$\Delta; \Gamma H; C_{4y}^+, \sigma_x, I\mathcal{T};$	$R_6;$	2;	$\frac{\sigma_0+i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
	$R_7;$	2;	$-\frac{\sigma_0-i\sigma_2}{\sqrt{2}}, i\sigma_1, -i\sigma_2;$	
$\Lambda; \Gamma P; C_{31}^-, \sigma_{db}, I\mathcal{T};$	$\{R_3, R_4\};$	2;	$-\sigma_0, i\sigma_3, -i\sigma_2;$	
	$R_6;$	2;	$\frac{1}{2}(\sigma_0 - i\sqrt{3}\sigma_2), i\sigma_3, -i\sigma_2;$	
$D; \Gamma P; C_{2z}, \sigma_{db}, I\mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, \sigma_3, -i\sigma_2;$	
	$\{R_7, R_8\};$	2;	$-i\sigma_0, -\sigma_3, -i\sigma_2;$	
$G; \Gamma N; C_{2b}, \sigma_{da}, I\mathcal{T};$	$\{R_5, R_6\};$	2;	$i\sigma_0, i\sigma_3, -i\sigma_2;$	
	$\{R_7, R_8\};$	2;	$-i\sigma_0, -i\sigma_3, -i\sigma_2;$	
	$\{R_9, R_{10}\};$	2;	$-i\sigma_0, \sqrt[4]{-1}\sigma_3, \sigma_0, -i\sigma_2;$	
$F; \Gamma H; C_{34}^+, \sigma_{da}, E, I\mathcal{T};$	$R_{12};$	2;	$\frac{1}{2}(\sqrt{3}\sigma_2 + i\sigma_0), \sqrt[4]{-1}\sigma_3, \sigma_0, -i\sigma_2;$	

## B. The accidental degeneracies on high-symmetry line

### 1. Notes to Sec. S8 B

- (i) For each table in Sec. S8 B, the first line presents the SG number.
- (ii) Below the first line, the columns from left to right (separated by the semicolons) are the high-symmetry momentum  $\mathbf{k}$ , the location of  $\mathbf{k}$ , the generating elements of the little group at  $\mathbf{k}$  (only point-group operators are presented and a full expression of each generating element can be found in Sec. S5), the two distinct coreps (separated by the comma) of the bands forming the accidental degeneracy, the degeneracy of the accidental degeneracy, the matrix representations of the generating elements, the species and the topological charge of the accidental degeneracy.
- (iii) We do not list the type II MSGs that do not exhibit symmetry-protected accidental degeneracies on high-symmetry line.

### 2. SG 1-10

## SG 3

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $V$ ; BD;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $W$ ; YC;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $U$ ; AE;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1

## SG 4

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $V$ ; BD;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $W$ ; YC;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $U$ ; AE;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1

## SG 5

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $U$ ; AM;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1

## SG 13

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Accidental degeneracies on high symmetry line

$V$ ; BD;  $C_{2z}, IT$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $U$ ; AE;  $C_{2z}, IT$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 14

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Accidental degeneracies on high symmetry line

$V$ ; BD;  $C_{2z}, IT$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $U$ ; AE;  $C_{2z}, IT$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 15

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Accidental degeneracies on high symmetry line

$U$ ; AM;  $C_{2z}, IT$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 16

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma Y$ ;  $C_{2y}, \mathcal{T}C_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $D$ ; XS;  $C_{2y}, \mathcal{T}C_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $P$ ; UR;  $C_{2y}, \mathcal{T}C_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $B$ ; ZT;  $C_{2y}, \mathcal{T}C_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma X$ ;  $C_{2x}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $C$ ; YS;  $C_{2x}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $E$ ; TR;  $C_{2x}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $A$ ; ZU;  $C_{2x}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \mathcal{T}C_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $H$ ; YT;  $C_{2z}, \mathcal{T}C_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ; SR;  $C_{2z}, \mathcal{T}C_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $G$ ; XU;  $C_{2z}, \mathcal{T}C_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 17

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma Y$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $D$ ;  $XS$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma X$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $C$ ;  $YS$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $H$ ;  $YT$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $SR$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $G$ ;  $XU$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 18

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma Y$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $B$ ;  $ZT$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma X$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $A$ ;  $ZU$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $SR$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; C-2 DP; 2

## SG 19

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma Y$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $P$ ;  $UR$ ;  $C_{2y}, \bar{E}, \mathcal{TC}_{2x}$ ;  $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $-i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; C-2 DP; 2  
 $\Sigma$ ;  $\Gamma X$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $E$ ;  $TR$ ;  $C_{2x}, \bar{E}, \mathcal{TC}_{2z}$ ;  $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $-i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; C-2 DP; 2  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $SR$ ;  $C_{2z}, \bar{E}, \mathcal{TC}_{2x}$ ;  $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; C-2 DP; 2

## SG 20

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $H$ ;  $YT$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $D$ ;  $SR$ ;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma Y$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Delta$ ;  $\Gamma \Delta$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $F$ ;  $YF$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $C$ ;  $YC$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 21

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $H$ ;  $YT$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $D$ ;  $SR$ ;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $A$ ;  $ZT$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma Y$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Delta$ ;  $\Gamma \Delta$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $B$ ;  $ZB$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $G$ ;  $TG$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $F$ ;  $YF$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $E$ ;  $TE$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $C$ ;  $YC$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 22

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z/\Gamma \Lambda$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $G$ ;  $XG/XY$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $H$ ;  $YH/YX$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $ZQ$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma X/\Gamma \Sigma$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $C$ ;  $YC/YZ$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $A$ ;  $ZA/ZY$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $U$ ;  $XU$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Delta$ ;  $\Gamma Y/\Gamma \Delta$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $D$ ;  $XD/XZ$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $B$ ;  $ZB/ZX$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $R$ ;  $YR$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 23

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 Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma\Lambda/\Gamma X$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $G$ ;  $XG$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $P$ ;  $TW$ ;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma\Sigma/\Gamma X$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $F$ ;  $XF$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $D$ ;  $SW$ ;  $C_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $\Delta$ ;  $\Gamma\Delta/\Gamma X$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $U$ ;  $XU$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $RW$ ;  $C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1

## SG 24

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 Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma\Lambda/\Gamma X$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $G$ ;  $XG$ ;  $C_{2z}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $P$ ;  $TW$ ;  $C_{2z}, \bar{E}$ ;  $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, -\sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma\Sigma/\Gamma X$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $F$ ;  $XF$ ;  $C_{2x}, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $D$ ;  $SW$ ;  $C_{2x}, \bar{E}$ ;  $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, -\sigma_0$ ; C-1 WP; 1  
 $\Delta$ ;  $\Gamma\Delta/\Gamma X$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $U$ ;  $XU$ ;  $C_{2y}, \mathcal{TC}_{2x}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $RW$ ;  $C_{2y}, \bar{E}$ ;  $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, -\sigma_0$ ; C-1 WP; 1

## SG 25

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 Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma Y$ ;  $\sigma_x, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $D$ ;  $XS$ ;  $\sigma_x, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $P$ ;  $UR$ ;  $\sigma_x, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $B$ ;  $ZT$ ;  $\sigma_x, \mathcal{TC}_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Sigma$ ;  $\Gamma X$ ;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $C$ ;  $YS$ ;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $E$ ;  $TR$ ;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $A$ ;  $ZU$ ;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 26

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{TC}_{2z}$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$D$ ; $XS$ ; $\sigma_x, \mathcal{TC}_{2z}$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$P$ ; $UR$ ; $\sigma_x, \mathcal{TC}_{2z}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; $4; i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0	
$B$ ; $ZT$ ; $\sigma_x, \mathcal{TC}_{2z}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; $4; i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0	
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$C$ ; $YS$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	

## SG 27

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{TC}_{2z}$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$D$ ; $XS$ ; $\sigma_x, \mathcal{TC}_{2z}$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$C$ ; $YS$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	

## SG 28

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{TC}_{2z}$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$D$ ; $XS$ ; $\sigma_x, \mathcal{TC}_{2z}$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$P$ ; $UR$ ; $\sigma_x, \mathcal{TC}_{2z}$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$B$ ; $ZT$ ; $\sigma_x, \mathcal{TC}_{2z}$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$A$ ; $ZU$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ; $2; -i\sigma_0, i\sigma_3$ ; P-WNLs;	
	$\{R_5\}, \{R_7\}$ ; $2; -i\sigma_3, i\sigma_3$ ; P-WNL;
	$\{R_5\}, \{R_8\}$ ; $2; -i\sigma_3, i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_7\}$ ; $2; -i\sigma_3, -i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_8\}$ ; $2; -i\sigma_3, -i\sigma_3$ ; P-WNL;
	$\{R_7\}, \{R_8\}$ ; $2; i\sigma_0, -i\sigma_3$ ; P-WNLs;
$Q$ ; $SR$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ; $2; -i\sigma_0, i\sigma_3$ ; P-WNLs;	
	$\{R_5\}, \{R_7\}$ ; $2; -i\sigma_3, i\sigma_3$ ; P-WNL;
	$\{R_5\}, \{R_8\}$ ; $2; -i\sigma_3, i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_7\}$ ; $2; -i\sigma_3, -i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_8\}$ ; $2; -i\sigma_3, -i\sigma_3$ ; P-WNL;
	$\{R_7\}, \{R_8\}$ ; $2; i\sigma_0, -i\sigma_3$ ; P-WNLs;



## SG 29

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$D$ ; $XS$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$P$ ; $UR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0	
$B$ ; $ZT$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0	
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$E$ ; $TR$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0	
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ; 2; $-i\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_5\}, \{R_7\}$ ; 2; $-i\sigma_3, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_8\}$ ; 2; $-i\sigma_3, i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_7\}$ ; 2; $-i\sigma_3, -i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, -i\sigma_3$ ; P-WNL;	
$\{R_7\}, \{R_8\}$ ; 2; $i\sigma_0, -i\sigma_3$ ; P-WNLs;	
$Q$ ; $SR$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ; 2; $-i\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_5\}, \{R_7\}$ ; 2; $-i\sigma_3, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_8\}$ ; 2; $-i\sigma_3, i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_7\}$ ; 2; $-i\sigma_3, -i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, -i\sigma_3$ ; P-WNL;	
$\{R_7\}, \{R_8\}$ ; 2; $i\sigma_0, -i\sigma_3$ ; P-WNLs;	

## SG 30

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$D$ ; $XS$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$E$ ; $TR$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ; 2; $-i\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_5\}, \{R_7\}$ ; 2; $-i\sigma_3, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_8\}$ ; 2; $-i\sigma_3, i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_7\}$ ; 2; $-i\sigma_3, -i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, -i\sigma_3$ ; P-WNL;	
$\{R_7\}, \{R_8\}$ ; 2; $i\sigma_0, -i\sigma_3$ ; P-WNLs;	
$Q$ ; $SR$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ; 2; $-i\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_5\}, \{R_7\}$ ; 2; $-i\sigma_3, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_8\}$ ; 2; $-i\sigma_3, i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_7\}$ ; 2; $-i\sigma_3, -i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_8\}$ ; 2; $-i\sigma_3, -i\sigma_3$ ; P-WNL;	
$\{R_7\}, \{R_8\}$ ; 2; $i\sigma_0, -i\sigma_3$ ; P-WNLs;	

## 5. SG 31-40

## SG 31

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$D$ ; $XS$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$A$ ; $ZU$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ;	4; $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ;	DP; 0
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ;	2; $-i\sigma_0, i\sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ;	2; $-i\sigma_3, i\sigma_3$ ; P-WNL;
	$\{R_5\}, \{R_8\}$ ;	2; $-i\sigma_3, i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_7\}$ ;	2; $-i\sigma_3, -i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_8\}$ ;	2; $-i\sigma_3, -i\sigma_3$ ; P-WNL;
	$\{R_7\}, \{R_8\}$ ;	2; $i\sigma_0, -i\sigma_3$ ; P-WNLs;
$Q$ ; $SR$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ;	2; $-i\sigma_0, i\sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ;	2; $-i\sigma_3, i\sigma_3$ ; P-WNL;
	$\{R_5\}, \{R_8\}$ ;	2; $-i\sigma_3, i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_7\}$ ;	2; $-i\sigma_3, -i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_8\}$ ;	2; $-i\sigma_3, -i\sigma_3$ ; P-WNL;
	$\{R_7\}, \{R_8\}$ ;	2; $i\sigma_0, -i\sigma_3$ ; P-WNLs;

## SG 32

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$B$ ; $ZT$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$A$ ; $ZU$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ;	2; $-i\sigma_0, i\sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ;	2; $-i\sigma_3, i\sigma_3$ ; P-WNL;
	$\{R_5\}, \{R_8\}$ ;	2; $-i\sigma_3, i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_7\}$ ;	2; $-i\sigma_3, -i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_8\}$ ;	2; $-i\sigma_3, -i\sigma_3$ ; P-WNL;
	$\{R_7\}, \{R_8\}$ ;	2; $i\sigma_0, -i\sigma_3$ ; P-WNLs;
$G$ ; $XU$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ;	2; $-i\sigma_0, i\sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ;	2; $-i\sigma_3, i\sigma_3$ ; P-WNL;
	$\{R_5\}, \{R_8\}$ ;	2; $-i\sigma_3, i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_7\}$ ;	2; $-i\sigma_3, -i\sigma_0$ ; P-WNL;
	$\{R_6\}, \{R_8\}$ ;	2; $-i\sigma_3, -i\sigma_3$ ; P-WNL;
	$\{R_7\}, \{R_8\}$ ;	2; $i\sigma_0, -i\sigma_3$ ; P-WNLs;

## SG 33

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$B$ ; $ZT$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; $4; i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0	
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$E$ ; $TR$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; $4; i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0	
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ; $2; -i\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_5\}, \{R_7\}$ ; $2; -i\sigma_3, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_8\}$ ; $2; -i\sigma_3, i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_7\}$ ; $2; -i\sigma_3, -i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_8\}$ ; $2; -i\sigma_3, -i\sigma_3$ ; P-WNL;	
$\{R_7\}, \{R_8\}$ ; $2; i\sigma_0, -i\sigma_3$ ; P-WNLs;	
$G$ ; $XU$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ; $2; -i\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_5\}, \{R_7\}$ ; $2; -i\sigma_3, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_8\}$ ; $2; -i\sigma_3, i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_7\}$ ; $2; -i\sigma_3, -i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_8\}$ ; $2; -i\sigma_3, -i\sigma_3$ ; P-WNL;	
$\{R_7\}, \{R_8\}$ ; $2; i\sigma_0, -i\sigma_3$ ; P-WNLs;	

## SG 34

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma Y$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$P$ ; $UR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$\Sigma$ ; $\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$E$ ; $TR$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; $2; i\sigma_3, \sigma_0$ ; P-WNL;	
$H$ ; $YT$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ; $2; -i\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_5\}, \{R_7\}$ ; $2; -i\sigma_3, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_8\}$ ; $2; -i\sigma_3, i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_7\}$ ; $2; -i\sigma_3, -i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_8\}$ ; $2; -i\sigma_3, -i\sigma_3$ ; P-WNL;	
$\{R_7\}, \{R_8\}$ ; $2; i\sigma_0, -i\sigma_3$ ; P-WNLs;	
$G$ ; $XU$ ; $C_{2z}, \sigma_y$ ; $\{R_5\}, \{R_6\}$ ; $2; -i\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_5\}, \{R_7\}$ ; $2; -i\sigma_3, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_8\}$ ; $2; -i\sigma_3, i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_7\}$ ; $2; -i\sigma_3, -i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_8\}$ ; $2; -i\sigma_3, -i\sigma_3$ ; P-WNL;	
$\{R_7\}, \{R_8\}$ ; $2; i\sigma_0, -i\sigma_3$ ; P-WNLs;	

## SG 35

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Accidental degeneracies on high symmetry line

$D$ ; SR;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $A$ ; ZT;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Sigma$ ;  $\Gamma Y$ ;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Delta$ ;  $\Gamma\Delta$ ;  $\sigma_x, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $B$ ; ZB;  $\sigma_x, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $G$ ; TG;  $\sigma_x, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $F$ ; YF;  $\sigma_x, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $E$ ; TE;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $C$ ; YC;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 36

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Accidental degeneracies on high symmetry line

$D$ ; SR;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $A$ ; ZT;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $\Sigma$ ;  $\Gamma Y$ ;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Delta$ ;  $\Gamma\Delta$ ;  $\sigma_x, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $F$ ; YF;  $\sigma_x, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $E$ ; TE;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $C$ ; YC;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 37

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Accidental degeneracies on high symmetry line

$D$ ; SR;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma Y$ ;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Delta$ ;  $\Gamma\Delta$ ;  $\sigma_x, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $F$ ; YF;  $\sigma_x, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $C$ ; YC;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 38

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $\sigma_x, \mathcal{T}\sigma_z$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $H$ ; YT;  $\sigma_x, \mathcal{T}\sigma_z$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $A$ ; ZT;  $\sigma_z, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Sigma$ ;  $\Gamma Y$ ;  $\sigma_z, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $E$ ; TE;  $\sigma_z, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $C$ ; YC;  $\sigma_z, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

SG 39

Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $\sigma_x, \mathcal{T}\sigma_z$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $H$ ;  $YT$ ;  $\sigma_x, \mathcal{T}\sigma_z$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $A$ ;  $ZT$ ;  $\sigma_z, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Sigma$ ;  $\Gamma Y$ ;  $\sigma_z, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $E$ ;  $TE$ ;  $\sigma_z, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $C$ ;  $YC$ ;  $\sigma_z, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

SG 40

Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $\sigma_x, \mathcal{T}\sigma_z$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $H$ ;  $YT$ ;  $\sigma_x, \mathcal{T}\sigma_z$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Sigma$ ;  $\Gamma Y$ ;  $\sigma_z, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $B$ ;  $ZB$ ;  $\sigma_z, C_{2y}$ ;  $\{R_5\}, \{R_6\}$ ; 2;  $i\sigma_0, i\sigma_3$ ; P-WNL;  
 $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, i\sigma_3$ ; P-WNL;  
 $\{R_5\}, \{R_8\}$ ; 2;  $i\sigma_3, i\sigma_0$ ; P-WNLs;  
 $\{R_6\}, \{R_7\}$ ; 2;  $i\sigma_3, -i\sigma_0$ ; P-WNLs;  
 $\{R_6\}, \{R_8\}$ ; 2;  $i\sigma_3, -i\sigma_3$ ; P-WNL;  
 $\{R_7\}, \{R_8\}$ ; 2;  $-i\sigma_0, -i\sigma_3$ ; P-WNL;  
 $G$ ;  $TG$ ;  $\sigma_z, C_{2y}$ ;  $\{R_5\}, \{R_6\}$ ; 2;  $i\sigma_0, i\sigma_3$ ; P-WNL;  
 $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, i\sigma_3$ ; P-WNL;  
 $\{R_5\}, \{R_8\}$ ; 2;  $i\sigma_3, i\sigma_0$ ; P-WNLs;  
 $\{R_6\}, \{R_7\}$ ; 2;  $i\sigma_3, -i\sigma_0$ ; P-WNLs;  
 $\{R_6\}, \{R_8\}$ ; 2;  $i\sigma_3, -i\sigma_3$ ; P-WNL;  
 $\{R_7\}, \{R_8\}$ ; 2;  $-i\sigma_0, -i\sigma_3$ ; P-WNL;  
 $C$ ;  $YC$ ;  $\sigma_z, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

SG 41

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $\sigma_x, \mathcal{T}\sigma_z$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$H$ ; $YT$ ; $\sigma_x, \mathcal{T}\sigma_z$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma Y$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$B$ ; $ZB$ ; $\sigma_z, C_{2y}$ ; $\{R_5\}, \{R_6\}$ ; 2; $i\sigma_0, i\sigma_3$ ; P-WNL;
$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, i\sigma_3$ ; P-WNL;
$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_3, i\sigma_0$ ; P-WNLs;
$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_3, -i\sigma_0$ ; P-WNLs;
$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -i\sigma_3$ ; P-WNL;
$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_0, -i\sigma_3$ ; P-WNL;
$G$ ; $TG$ ; $\sigma_z, C_{2y}$ ; $\{R_5\}, \{R_6\}$ ; 2; $i\sigma_0, i\sigma_3$ ; P-WNL;
$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, i\sigma_3$ ; P-WNL;
$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_3, i\sigma_0$ ; P-WNLs;
$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_3, -i\sigma_0$ ; P-WNLs;
$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -i\sigma_3$ ; P-WNL;
$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_0, -i\sigma_3$ ; P-WNL;
$C$ ; $YC$ ; $\sigma_z, \mathcal{T}C_{2y}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;

SG 42

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma X/\Gamma\Sigma$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$C$ ; $YC/YZ$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$A$ ; $ZA/ZY$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$U$ ; $XU$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\Delta$ ; $\Gamma Y/\Gamma\Delta$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$D$ ; $XD/XZ$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$B$ ; $ZB/ZX$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$R$ ; $YR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 43

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Accidental degeneracies on high symmetry line

$G$ ; XG/XY; $C_{2z}, \sigma_y$ ;	$\{R_5\}, \{R_6\}$ ;	$2; i\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ;	$2; i\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_5\}, \{R_8\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_6\}, \{R_7\}$ ;	$2; i\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_6\}, \{R_8\}$ ;	$2; i\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_7\}, \{R_8\}$ ;	$2; -i\sigma_0, -\sigma_3$ ;	P-WNLs;
$H$ ; YH/YX; $C_{2z}, \sigma_y$ ;	$\{R_5\}, \{R_6\}$ ;	$2; i\sigma_0, \sigma_3$ ;	P-WNLs;
	$\{R_5\}, \{R_7\}$ ;	$2; i\sigma_3, \sigma_3$ ;	P-WNL;
	$\{R_5\}, \{R_8\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;
	$\{R_6\}, \{R_7\}$ ;	$2; i\sigma_3, -\sigma_0$ ;	P-WNL;
	$\{R_6\}, \{R_8\}$ ;	$2; i\sigma_3, -\sigma_3$ ;	P-WNL;
	$\{R_7\}, \{R_8\}$ ;	$2; -i\sigma_0, -\sigma_3$ ;	P-WNLs;
$\Sigma$ ; $\Gamma X/\Gamma \Sigma$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; XU; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma Y/\Gamma \Delta$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;
$R$ ; YR; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;

## SG 44

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Accidental degeneracies on high symmetry line

$P$ ; TW; $C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma \Sigma/\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; XF; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma \Delta/\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; XU; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;

## SG 45

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Accidental degeneracies on high symmetry line

$P$ ; TW; $C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma \Sigma/\Gamma X$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;
$F$ ; XF; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;
$\Delta$ ; $\Gamma \Delta/\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; XU; $\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;

## SG 46

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Accidental degeneracies on high symmetry line

$P$ ; TW;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma\Sigma/\Gamma X$ ;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $F$ ; XF;  $\sigma_y, \mathcal{T}\sigma_x$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Delta$ ;  $\Gamma\Delta/\Gamma X$ ;  $\sigma_x, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $U$ ; XU;  $\sigma_x, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 47

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Accidental degeneracies on high symmetry line

## SG 48

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Accidental degeneracies on high symmetry line

$D$ ; XS;  $\sigma_x, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $B$ ; ZT;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $C$ ; YS;  $\sigma_y, C_{2x}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $A$ ; ZU;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4;  $i\Gamma_{0,3}, \Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0  
 $H$ ; YT;  $\sigma_y, C_{2z}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $G$ ; XU;  $\sigma_x, C_{2z}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 49

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Accidental degeneracies on high symmetry line

$P$ ; UR;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $B$ ; ZT;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $E$ ; TR;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4;  $i\Gamma_{0,3}, \Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0  
 $A$ ; ZU;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4;  $i\Gamma_{0,3}, \Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0

## SG 50

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Accidental degeneracies on high symmetry line

$D$ ; XS;  $\sigma_x, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $P$ ; UR;  $\sigma_x, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $C$ ; YS;  $\sigma_y, C_{2x}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $E$ ; TR;  $\sigma_y, C_{2x}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $H$ ; YT;  $\sigma_y, C_{2z}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $G$ ; XU;  $\sigma_x, C_{2z}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0



## 7. SG 51-60

## SG 51

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Accidental degeneracies on high symmetry line

$P$ ; UR;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $B$ ; ZT;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;

## SG 52

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Accidental degeneracies on high symmetry line

$D$ ; XS;  $\sigma_x, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $B$ ; ZT;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $C$ ; YS;  $\sigma_y, C_{2x}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $E$ ; TR;  $\sigma_y, \sigma_z, \bar{E}, IT$ ;  $\{R_6, R_8\}, \{R_7, R_9\}$ ; 4;  $i\Gamma_{0,3}, \Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $H$ ; YT;  $\sigma_y, C_{2z}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $G$ ; XU;  $\sigma_x, C_{2z}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 53

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Accidental degeneracies on high symmetry line

$P$ ; UR;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $B$ ; ZT;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $C$ ; YS;  $\sigma_y, C_{2x}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $E$ ; TR;  $\sigma_y, C_{2x}, \bar{E}, IT$ ;  $\{R_6, R_9\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{0,3}, -i\Gamma_{3,3}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $H$ ; YT;  $\sigma_y, C_{2z}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $Q$ ; SR;  $\sigma_y, C_{2z}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 54

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Accidental degeneracies on high symmetry line

$D$ ; XS;  $\sigma_x, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $B$ ; ZT;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $Q$ ; SR;  $\sigma_x, C_{2z}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $G$ ; XU;  $\sigma_x, C_{2z}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 55

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Accidental degeneracies on high symmetry line

$H$ ; YT;  $\sigma_y, C_{2z}, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $-i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $G$ ; XU;  $\sigma_x, C_{2z}, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;

## SG 56

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 Accidental degeneracies on high symmetry line

$D$ ; XS;  $C_{2y,\sigma_x,IT}$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $B$ ; ZT;  $\sigma_z, C_{2y,IT}$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $C$ ; YS;  $C_{2x,\sigma_z,IT}$ ;  $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4;  $-i\Gamma_{0,3}, -\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $A$ ; ZU;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4;  $i\Gamma_{0,3}, \Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0

## SG 57

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 Accidental degeneracies on high symmetry line

$D$ ; XS;  $C_{2y,\sigma_x,IT}$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $P$ ; UR;  $C_{2y,\sigma_x,IT}$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $H$ ; YT;  $\sigma_y, C_{2z,IT}$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $-i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $Q$ ; SR;  $\sigma_y, C_{2z,IT}$ ;  $\{R_5, R_5\}, \{R_6, R_6\}$ ; 4;  $-i\Gamma_{0,0}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $-i\Gamma_{3,0}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $\{R_5, R_5\}, \{R_8, R_8\}$ ; 4;  $-i\Gamma_{3,0}, i\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;  
 $\{R_6, R_6\}, \{R_7, R_7\}$ ; 4;  $-i\Gamma_{3,0}, -i\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;  
 $\{R_6, R_6\}, \{R_8, R_8\}$ ; 4;  $-i\Gamma_{3,0}, -i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $\{R_7, R_7\}, \{R_8, R_8\}$ ; 4;  $i\Gamma_{0,0}, -i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;

## SG 58

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 Accidental degeneracies on high symmetry line

$P$ ; UR;  $C_{2y,\sigma_x,\bar{E},IT}$ ;  $\{R_6, R_8\}, \{R_7, R_9\}$ ; 4;  $-i\Gamma_{0,3}, -i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $B$ ; ZT;  $\sigma_z, C_{2y,IT}$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $E$ ; TR;  $C_{2x,\sigma_z,\bar{E},IT}$ ;  $\{R_6, R_9\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{0,3}, -i\Gamma_{3,3}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $A$ ; ZU;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0  
 $H$ ; YT;  $\sigma_y, C_{2z,IT}$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $-i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $G$ ; XU;  $\sigma_x, C_{2z,IT}$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;

## SG 59

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 Accidental degeneracies on high symmetry line

$D$ ; XS;  $C_{2y,\sigma_x,IT}$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $P$ ; UR;  $C_{2y,\sigma_x,IT}$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $C$ ; YS;  $C_{2x,\sigma_z,IT}$ ;  $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4;  $-i\Gamma_{0,3}, -\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $A$ ; TR;  $C_{2x,\sigma_z,IT}$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $-\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0

$P$ ; UR; $C_{2y}, \sigma_x, \bar{E}, IT$ ; $\{R_6, R_8\}, \{R_7, R_9\}$ ; 4; $-i\Gamma_{0,3}, -i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$B$ ; ZT; $\sigma_z, C_{2y}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0	
$C$ ; YS; $C_{2x}, \sigma_z, IT$ ; $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4; $-i\Gamma_{0,3}, -i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;	
$A$ ; ZU; $\sigma_z, \sigma_y, IT$ ; $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0	
$Q$ ; SR; $\sigma_x, C_{2z}, IT$ ; $\{R_5, R_5\}, \{R_6, R_6\}$ ; 4; $i\Gamma_{0,0}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_5, R_5\}, \{R_7, R_7\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_5, R_5\}, \{R_8, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;	
$\{R_6, R_6\}, \{R_7, R_7\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;	
$\{R_6, R_6\}, \{R_8, R_8\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_7, R_7\}, \{R_8, R_8\}$ ; 4; $-i\Gamma_{0,0}, -i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$G$ ; XU; $\sigma_x, C_{2z}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;	

## 8. SG 61-70

SG 61

Accidental degeneracies on high symmetry line

$P$ ; UR; $C_{2y}, \sigma_x, \bar{E}, IT$ ; $\{R_6, R_6\}, \{R_7, R_7\}$ ; 4; $-i\Gamma_{0,0}, -i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;	
$\{R_6, R_6\}, \{R_8, R_8\}$ ; 4; $-i\Gamma_{3,0}, -i\Gamma_{0,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_6, R_6\}, \{R_9, R_9\}$ ; 4; $-i\Gamma_{3,0}, -i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_7, R_7\}, \{R_8, R_8\}$ ; 4; $-i\Gamma_{3,0}, i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_7, R_7\}, \{R_9, R_9\}$ ; 4; $-i\Gamma_{3,0}, i\Gamma_{0,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_8, R_8\}, \{R_9, R_9\}$ ; 4; $i\Gamma_{0,0}, -i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;	
$B$ ; ZT; $\sigma_z, C_{2y}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;	
$C$ ; YS; $\sigma_y, C_{2x}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $-i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;	
$E$ ; TR; $C_{2x}, \sigma_z, \bar{E}, IT$ ; $\{R_6, R_6\}, \{R_7, R_7\}$ ; 4; $-i\Gamma_{0,0}, \Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;	
$\{R_6, R_6\}, \{R_8, R_8\}$ ; 4; $-i\Gamma_{3,0}, \Gamma_{0,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_6, R_6\}, \{R_9, R_9\}$ ; 4; $-i\Gamma_{3,0}, \Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_7, R_7\}, \{R_8, R_8\}$ ; 4; $-i\Gamma_{3,0}, -\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_7, R_7\}, \{R_9, R_9\}$ ; 4; $-i\Gamma_{3,0}, -\Gamma_{0,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_8, R_8\}, \{R_9, R_9\}$ ; 4; $i\Gamma_{0,0}, \Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;	
$Q$ ; SR; $C_{2z}, \sigma_y, \bar{E}, IT$ ; $\{R_6, R_6\}, \{R_7, R_7\}$ ; 4; $i\Gamma_{0,0}, \Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;	
$\{R_6, R_6\}, \{R_8, R_8\}$ ; 4; $i\Gamma_{3,0}, \Gamma_{0,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_6, R_6\}, \{R_9, R_9\}$ ; 4; $i\Gamma_{3,0}, \Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_7, R_7\}, \{R_8, R_8\}$ ; 4; $i\Gamma_{3,0}, -\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_7, R_7\}, \{R_9, R_9\}$ ; 4; $i\Gamma_{3,0}, -\Gamma_{0,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_8, R_8\}, \{R_9, R_9\}$ ; 4; $-i\Gamma_{0,0}, \Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;	
$G$ ; XU; $\sigma_x, C_{2z}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;	

SG 62

Accidental degeneracies on high symmetry line

$D$ ; XS; $C_{2y}, \sigma_x, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$B$ ; ZT; $\sigma_z, C_{2y}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;	
$H$ ; YT; $C_{2z}, \sigma_y, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$Q$ ; SR; $C_{2z}, \sigma_y, IT$ ; $\{R_5, R_5\}, \{R_6, R_6\}$ ; 4; $-i\Gamma_{0,0}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNLs;	
$\{R_5, R_5\}, \{R_7, R_7\}$ ; 4; $-i\Gamma_{3,0}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_5, R_5\}, \{R_8, R_8\}$ ; 4; $-i\Gamma_{3,0}, i\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_6, R_6\}, \{R_7, R_7\}$ ; 4; $-i\Gamma_{3,0}, -i\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_6, R_6\}, \{R_8, R_8\}$ ; 4; $-i\Gamma_{3,0}, -i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$\{R_7, R_7\}, \{R_8, R_8\}$ ; 4; $i\Gamma_{0,0}, -i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNLs;	

## SG 63

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Accidental degeneracies on high symmetry line

$A$ ; ZT;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $E$ ; TE;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;

## SG 64

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Accidental degeneracies on high symmetry line

$D$ ; SR;  $C_{2z}, IT$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $A$ ; ZT;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, \Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;  
 $E$ ; TE;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, \Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;

## SG 65

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Accidental degeneracies on high symmetry line

## SG 66

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Accidental degeneracies on high symmetry line

$A$ ; ZT;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0  
 $B$ ; ZB;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $G$ ; TG;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $E$ ; TE;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0

## SG 67

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Accidental degeneracies on high symmetry line

$D$ ; SR;  $C_{2z}, IT$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 68

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Accidental degeneracies on high symmetry line

$D$ ; SR;  $C_{2z}, IT$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $A$ ; ZT;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0  
 $B$ ; ZB;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $G$ ; TG;  $\sigma_z, C_{2y}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $E$ ; TE;  $\sigma_z, \sigma_y, IT$ ;  $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0

## SG 69

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Accidental degeneracies on high symmetry line

$G$ ;	$\text{XG/XY};$	$\sigma_x, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\}, \{R_6, R_7\};$	$4;$	$i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2};$	DP;	0
$H$ ;	$\text{YH/YX};$	$\sigma_y, C_{2z}, I\mathcal{T};$	$\{R_5, R_8\}, \{R_6, R_7\};$	$4;$	$-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2};$	DP;	0
$C$ ;	$\text{YC/YZ};$	$\sigma_y, C_{2x}, I\mathcal{T};$	$\{R_5, R_8\}, \{R_6, R_7\};$	$4;$	$-i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2};$	DP;	0
$A$ ;	$\text{ZA/ZY};$	$\sigma_z, \sigma_y, I\mathcal{T};$	$\{R_5, R_7\}, \{R_6, R_8\};$	$4;$	$i\Gamma_{0,3}, \Gamma_{3,3}, -i\Gamma_{0,2};$	DP;	0
$D$ ;	$\text{XD/XZ};$	$\sigma_x, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\}, \{R_6, R_7\};$	$4;$	$i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2};$	DP;	0
$B$ ;	$\text{ZB/ZX};$	$\sigma_z, C_{2y}, I\mathcal{T};$	$\{R_5, R_8\}, \{R_6, R_7\};$	$4;$	$i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2};$	DP;	0

## 9. SG 71-80

## SG 71

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 Accidental degeneracies on high symmetry line

## SG 72

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 Accidental degeneracies on high symmetry line

 $D$ ; SW;  $C_{2x}, IT$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

 $Q$ ; RW;  $C_{2y}, IT$ ;  $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4;  $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 73

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 Accidental degeneracies on high symmetry line

 $P$ ; TW;  $C_{2z}, \bar{E}, IT$ ;  $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $-i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0

 $D$ ; SW;  $C_{2x}, \bar{E}, IT$ ;  $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0

 $Q$ ; RW;  $C_{2y}, \bar{E}, IT$ ;  $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $-i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 74

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 Accidental degeneracies on high symmetry line

 $P$ ; TW;  $C_{2z}, \bar{E}, IT$ ;  $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $-i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 75

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 Accidental degeneracies on high symmetry line

 $\Lambda$ ;  $\Gamma Z$ ;  $C_{4z}^+$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $\frac{\sigma_3 + i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1

 $\{R_2\}, \{R_6\}$ ; 2;  $\sqrt[4]{-1}\sigma_3$ ; C-2 WP; 2

 $\{R_2\}, \{R_8\}$ ; 2;  $\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1

 $\{R_4\}, \{R_6\}$ ; 2;  $-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1

 $\{R_4\}, \{R_8\}$ ; 2;  $(-1)^{3/4}\sigma_3$ ; C-2 WP; 2

 $\{R_6\}, \{R_8\}$ ; 2;  $\frac{-\sigma_3 - i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1

 $V$ ; MA;  $C_{4z}^+$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $\frac{\sigma_3 + i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1

 $\{R_2\}, \{R_6\}$ ; 2;  $\sqrt[4]{-1}\sigma_3$ ; C-2 WP; 2

 $\{R_2\}, \{R_8\}$ ; 2;  $\frac{\sigma_0 + i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1

 $\{R_4\}, \{R_6\}$ ; 2;  $-\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1

 $\{R_4\}, \{R_8\}$ ; 2;  $(-1)^{3/4}\sigma_3$ ; C-2 WP; 2

 $\{R_6\}, \{R_8\}$ ; 2;  $\frac{-\sigma_3 - i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1

 $W$ ; XR;  $C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1

SG 76

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3$ ; C-2 WP; 2	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$V$ ; $MA$ ; $C_{4z}^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3$ ; C-2 WP; 2	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$W$ ; $XR$ ; $C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	

SG 77

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3$ ; C-2 WP; 2	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$V$ ; $MA$ ; $C_{4z}^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3$ ; C-2 WP; 2	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$W$ ; $XR$ ; $C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	



SG 78

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3$ ; C-2 WP; 2	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$V$ ; $MA$ ; $C_{4z}^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3$ ; C-2 WP; 2	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$W$ ; $XR$ ; $C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	

SG 79

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3$ ; C-2 WP; 2	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$V$ ; $ZV$ ; $C_{4z}^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3$ ; C-2 WP; 2	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}$ ; C-1 WP; 1	
$W$ ; $XP$ ; $C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+$ ;	$\{R_2\}, \{R_4\}; 2; \frac{\sigma_3+i\sigma_0}{\sqrt{2}};$	C-1 WP; 1
		$\{R_2\}, \{R_6\}; 2; \sqrt[4]{-1}\sigma_3;$	C-2 WP; 2
		$\{R_2\}, \{R_8\}; 2; \frac{\sigma_0+i\sigma_3}{\sqrt{2}};$	C-1 WP; 1
		$\{R_4\}, \{R_6\}; 2; -\frac{\sigma_0-i\sigma_3}{\sqrt{2}};$	C-1 WP; 1
		$\{R_4\}, \{R_8\}; 2; (-1)^{3/4}\sigma_3;$	C-2 WP; 2
		$\{R_6\}, \{R_8\}; 2; \frac{-\sigma_3-i\sigma_0}{\sqrt{2}};$	C-1 WP; 1
$V$ ; $ZV$ ;	$C_{4z}^+, \bar{E}$ ;	$\{R_2\}, \{R_4\}; 2; \frac{\sigma_3+i\sigma_0}{\sqrt{2}}, -\sigma_0;$	C-1 WP; 1
		$\{R_2\}, \{R_6\}; 2; \sqrt[4]{-1}\sigma_3, -\sigma_0;$	C-2 WP; 2
		$\{R_2\}, \{R_8\}; 2; \frac{\sigma_0+i\sigma_3}{\sqrt{2}}, -\sigma_0;$	C-1 WP; 1
		$\{R_4\}, \{R_6\}; 2; -\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, -\sigma_0;$	C-1 WP; 1
		$\{R_4\}, \{R_8\}; 2; (-1)^{3/4}\sigma_3, -\sigma_0;$	C-2 WP; 2
		$\{R_6\}, \{R_8\}; 2; \frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, -\sigma_0;$	C-1 WP; 1
$W$ ; $XP$ ;	$C_{2z}$ ;	$\{R_2\}, \{R_4\}; 2; i\sigma_3;$	C-1 WP; 1

## 10. SG 81-90

## SG 81

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 Accidental degeneracies on high symmetry line

 $W; \text{XR}; C_{2z}; \{R_2\}, \{R_4\}; 2; i\sigma_3; \text{C-1 WP}; 1$ 

## SG 82

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 Accidental degeneracies on high symmetry line

 $W; \text{XP}; C_{2z}; \{R_2\}, \{R_4\}; 2; i\sigma_3; \text{C-1 WP}; 1$ 

## SG 83

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 Accidental degeneracies on high symmetry line

 $\Lambda; \Gamma Z; C_{4z}^+, IT; \{R_2, R_8\}, \{R_4, R_6\}; 4; \frac{\Gamma_{3,0} + i\Gamma_{0,3}}{\sqrt{2}}, -i\Gamma_{0,2}; \text{DP}; 0$   
 $V; \text{MA}; C_{4z}^+, IT; \{R_2, R_8\}, \{R_4, R_6\}; 4; \frac{\Gamma_{3,0} + i\Gamma_{0,3}}{\sqrt{2}}, -i\Gamma_{0,2}; \text{DP}; 0$ 

## SG 84

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 Accidental degeneracies on high symmetry line

 $\Lambda; \Gamma Z; C_{4z}^+, IT; \{R_2, R_8\}, \{R_4, R_6\}; 4; \frac{\Gamma_{3,0} + i\Gamma_{0,3}}{\sqrt{2}}, -i\Gamma_{0,2}; \text{DP}; 0$   
 $V; \text{MA}; C_{4z}^+, IT; \{R_2, R_8\}, \{R_4, R_6\}; 4; \frac{\Gamma_{3,0} + i\Gamma_{0,3}}{\sqrt{2}}, -i\Gamma_{0,2}; \text{DP}; 0$ 

## SG 85

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 Accidental degeneracies on high symmetry line

 $\Lambda; \Gamma Z; C_{4z}^+, IT; \{R_2, R_8\}, \{R_4, R_6\}; 4; \frac{\Gamma_{3,0} + i\Gamma_{0,3}}{\sqrt{2}}, -i\Gamma_{0,2}; \text{DP}; 0$   
 $V; \text{MA}; C_{4z}^+, E, IT; \{R_{10}, R_{12}\}, \{R_{14}, R_{16}\}; 4; \frac{-\Gamma_{3,3} - i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,0}, -i\Gamma_{0,2}; \text{DP}; 0$   
 $W; \text{XR}; C_{2z}, IT; \{R_2, R_2\}, \{R_4, R_4\}; 4; i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0$ 

## SG 86

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 Accidental degeneracies on high symmetry line

 $\Lambda; \Gamma Z; C_{4z}^+, IT; \{R_2, R_8\}, \{R_4, R_6\}; 4; \frac{\Gamma_{3,0} + i\Gamma_{0,3}}{\sqrt{2}}, -i\Gamma_{0,2}; \text{DP}; 0$   
 $V; \text{MA}; C_{4z}^+, E, IT; \{R_{10}, R_{12}\}, \{R_{14}, R_{16}\}; 4; \frac{-\Gamma_{3,3} - i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,0}, -i\Gamma_{0,2}; \text{DP}; 0$   
 $W; \text{XR}; C_{2z}, IT; \{R_2, R_2\}, \{R_4, R_4\}; 4; i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0$

SG 87

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \Gamma\Lambda/\Gamma Z; C_{4z}^+, IT; \{R_2, R_8\}, \{R_4, R_6\}; 4; \frac{\Gamma_{3,0} + i\Gamma_{0,3}}{\sqrt{2}}, -i\Gamma_{0,2}; \text{DP}; 0 \\ V; ZV; C_{4z}^+, IT; \{R_2, R_8\}, \{R_4, R_6\}; 4; \frac{\Gamma_{3,0} + i\Gamma_{0,3}}{\sqrt{2}}, -i\Gamma_{0,2}; \text{DP}; 0 \end{aligned}$$

SG 88

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \Gamma\Lambda/\Gamma Z; C_{4z}^+, IT; \{R_2, R_8\}, \{R_4, R_6\}; 4; \frac{\Gamma_{3,0} + i\Gamma_{0,3}}{\sqrt{2}}, -i\Gamma_{0,2}; \text{DP}; 0 \\ V; ZV; C_{4z}^+, E, IT; \{R_{10}, R_{12}\}, \{R_{14}, R_{16}\}; 4; \frac{-\Gamma_{3,3} - i\Gamma_{3,0}}{\sqrt{2}}, \Gamma_{0,0}, -i\Gamma_{0,2}; \text{DP}; 0 \\ W; XP; C_{2z}, IT; \{R_2, R_2\}, \{R_4, R_4\}; 4; i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0 \end{aligned}$$

SG 89

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z}; \{R_2\}, \{R_4\}; 2; i\sigma_3, \sigma_0; \text{C-1 WP}; 1 \\ U; ZR; C_{2y}, \mathcal{T}C_{2z}; \{R_2\}, \{R_4\}; 2; i\sigma_3, \sigma_0; \text{C-1 WP}; 1 \\ \Lambda; \Gamma Z; C_{4z}^+, C_{2b}\mathcal{T}; \{R_2\}, \{R_4\}; 2; \frac{\sigma_3 + i\sigma_0}{\sqrt{2}}, \sigma_0; \text{C-1 WP}; 1 \\ \{R_2\}, \{R_6\}; 2; \sqrt[4]{-1}\sigma_3, \sigma_0; \text{C-2 WP}; 2 \\ \{R_2\}, \{R_8\}; 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0; \text{C-1 WP}; 1 \\ \{R_4\}, \{R_6\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0; \text{C-1 WP}; 1 \\ \{R_4\}, \{R_8\}; 2; (-1)^{3/4}\sigma_3, \sigma_0; \text{C-2 WP}; 2 \\ \{R_6\}, \{R_8\}; 2; \frac{-\sigma_3 - i\sigma_0}{\sqrt{2}}, \sigma_0; \text{C-1 WP}; 1 \\ V; \text{MA}; C_{4z}^+, C_{2b}\mathcal{T}; \{R_2\}, \{R_4\}; 2; \frac{\sigma_3 + i\sigma_0}{\sqrt{2}}, \sigma_0; \text{C-1 WP}; 1 \\ \{R_2\}, \{R_6\}; 2; \sqrt[4]{-1}\sigma_3, \sigma_0; \text{C-2 WP}; 2 \\ \{R_2\}, \{R_8\}; 2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0; \text{C-1 WP}; 1 \\ \{R_4\}, \{R_6\}; 2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0; \text{C-1 WP}; 1 \\ \{R_4\}, \{R_8\}; 2; (-1)^{3/4}\sigma_3, \sigma_0; \text{C-2 WP}; 2 \\ \{R_6\}, \{R_8\}; 2; \frac{-\sigma_3 - i\sigma_0}{\sqrt{2}}, \sigma_0; \text{C-1 WP}; 1 \\ \Sigma; \Gamma M; C_{2a}, C_{2b}\mathcal{T}; \{R_2\}, \{R_4\}; 2; i\sigma_3, \sigma_0; \text{C-1 WP}; 1 \\ S; Z\Lambda; C_{2a}, C_{2b}\mathcal{T}; \{R_2\}, \{R_4\}; 2; i\sigma_3, \sigma_0; \text{C-1 WP}; 1 \\ Y; X\text{M}; C_{2x}, \mathcal{T}C_{2y}; \{R_2\}, \{R_4\}; 2; i\sigma_3, \sigma_0; \text{C-1 WP}; 1 \\ T; R\Lambda; C_{2x}, \mathcal{T}C_{2y}; \{R_2\}, \{R_4\}; 2; i\sigma_3, \sigma_0; \text{C-1 WP}; 1 \\ W; X\text{R}; C_{2z}, \mathcal{T}C_{2y}; \{R_2\}, \{R_4\}; 2; i\sigma_3, \sigma_0; \text{C-1 WP}; 1 \end{aligned}$$

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 Accidental degeneracies on high symmetry line

$\Delta; \Gamma X; C_{2y}, \mathcal{T}C_{2z}; \{R_2\}, \{R_4\};$	$2; i\sigma_3, \sigma_0;$	C-1 WP; 1
$U; ZR; C_{2y}, \mathcal{T}C_{2z}; \{R_2\}, \{R_4\};$	$2; i\sigma_3, \sigma_0;$	C-1 WP; 1
$\Lambda; \Gamma Z; C_{4z}^+, C_{2b}\mathcal{T}; \{R_2\}, \{R_4\};$	$2; \frac{\sigma_3 + i\sigma_0}{\sqrt{2}}, \sigma_0;$	C-1 WP; 1
$\{R_2\}, \{R_6\};$	$2; \sqrt[4]{-1}\sigma_3, \sigma_0;$	C-2 WP; 2
$\{R_2\}, \{R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0;$	C-1 WP; 1
$\{R_4\}, \{R_6\};$	$2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0;$	C-1 WP; 1
$\{R_4\}, \{R_8\};$	$2; (-1)^{3/4}\sigma_3, \sigma_0;$	C-2 WP; 2
$\{R_6\}, \{R_8\};$	$2; \frac{-\sigma_3 - i\sigma_0}{\sqrt{2}}, \sigma_0;$	C-1 WP; 1
$V; MA; C_{4z}^+, C_{2b}\mathcal{T}; \{R_2, R_6\}, \{R_4, R_8\};$	$4; \frac{\Gamma_{3,3} + i\Gamma_{0,3}}{\sqrt{2}}, \Gamma_{0,1};$	C-2 DP; 2
$\Sigma; \Gamma M; C_{2a}, C_{2b}\mathcal{T}; \{R_2\}, \{R_4\};$	$2; i\sigma_3, \sigma_0;$	C-1 WP; 1
$S; ZA; C_{2a}, C_{2b}\mathcal{T}; \{R_2\}, \{R_4\};$	$2; i\sigma_3, \sigma_0;$	C-1 WP; 1

## SG 91

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$Y$ ; $XM$ ; $C_{2z}, \mathcal{T}C_{2y}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$W$ ; $XR$ ; $C_{2z}, \mathcal{T}C_{2y}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 92

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2, R_6\}, \{R_4, R_8\}$ ; 4; $\frac{\Gamma_{3,3}+i\Gamma_{0,3}}{\sqrt{2}}, \Gamma_{0,1}$ ; C-2 DP; 2
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$T$ ; $RA$ ; $C_{2x}, E, \mathcal{T}C_{2y}$ ; $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4; $-i\Gamma_{3,0}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; C-2 DP; 2

SG 93

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$U$ ; $ZR$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$S$ ; $ZA$ ; $C_{2a}, E, C_{2b}\mathcal{T}$ ; $\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ; C-1 WP; 1
$Y$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$T$ ; $RA$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$W$ ; $XR$ ; $C_{2z}, \mathcal{T}C_{2y}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1

SG 94

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$U$ ; $ZR$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2, R_6\}, \{R_4, R_8\}$ ; 4; $\frac{\Gamma_{3,3}+i\Gamma_{0,3}}{\sqrt{2}}, \Gamma_{0,1}$ ; C-2 DP; 2
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$S$ ; $ZA$ ; $C_{2a}, E, C_{2b}\mathcal{T}$ ; $\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ; C-1 WP; 1

SG 95

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$Y$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2y}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$W$ ; $XR$ ; $C_{2z}, \mathcal{T}C_{2y}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1

SG 96

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$V$ ; $MA$ ; $C_{4z}^+, C_{2b}\mathcal{T}$ ; $\{R_2, R_6\}, \{R_4, R_8\}$ ; 4; $\frac{\Gamma_{3,3}+i\Gamma_{0,3}}{\sqrt{2}}, \Gamma_{0,1}$ ; C-2 DP; 2
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$T$ ; $RA$ ; $C_{2x}, E, \mathcal{T}C_{2y}$ ; $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4; $i\Gamma_{3,0}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; C-2 DP; 2



## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, C_{2b}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; \frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
		$\{R_2\}, \{R_6\}$ ;	$2; \sqrt[4]{-1}\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_2\}, \{R_8\}$ ;	$2; \frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
		$\{R_4\}, \{R_6\}$ ;	$2; -\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
		$\{R_4\}, \{R_8\}$ ;	$2; (-1)^{3/4}\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_6\}, \{R_8\}$ ;	$2; \frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
$V$ ; $ZV$ ;	$C_{4z}^+, C_{2b}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; \frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
		$\{R_2\}, \{R_6\}$ ;	$2; \sqrt[4]{-1}\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_2\}, \{R_8\}$ ;	$2; \frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
		$\{R_4\}, \{R_6\}$ ;	$2; -\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
		$\{R_4\}, \{R_8\}$ ;	$2; (-1)^{3/4}\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_6\}, \{R_8\}$ ;	$2; \frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
$W$ ; $XP$ ;	$C_{2z}, C_{2b}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$F$ ; $ZF$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Q$ ; $NP$ ;	$C_{2y}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3$ ;	C-1 WP; 1
$\Delta$ ; $\Gamma X$ ;	$C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ZU$ ;	$C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Y$ ; $XZ/XY$ ;	$C_{2b}, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	C-1 WP; 1

SG 98

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, C_{2b}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
		$\{R_2\}, \{R_6\}$ ;	2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_2\}, \{R_8\}$ ;	2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
		$\{R_4\}, \{R_6\}$ ;	2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
		$\{R_4\}, \{R_8\}$ ;	2; $(-1)^{3/4}\sigma_3, \sigma_0$ ;	C-2 WP; 2
		$\{R_6\}, \{R_8\}$ ;	2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
$V$ ; $ZV$ ;	$C_{4z}^+, E, C_{2b}\mathcal{T}$ ;	$\{R_{10}\}, \{R_{12}\}$ ;	2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0, \sigma_0$ ;	C-1 WP; 1
		$\{R_{10}\}, \{R_{14}\}$ ;	2; $\sqrt[4]{-1}\sigma_3, \sigma_0, \sigma_0$ ;	C-2 WP; 2
		$\{R_{10}\}, \{R_{16}\}$ ;	2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0, \sigma_0$ ;	C-1 WP; 1
		$\{R_{12}\}, \{R_{14}\}$ ;	2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0, \sigma_0$ ;	C-1 WP; 1
		$\{R_{12}\}, \{R_{16}\}$ ;	2; $(-1)^{3/4}\sigma_3, \sigma_0, \sigma_0$ ;	C-2 WP; 2
		$\{R_{14}\}, \{R_{16}\}$ ;	2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0, \sigma_0$ ;	C-1 WP; 1
$W$ ; $XP$ ;	$C_{2z}, C_{2b}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$F$ ; $ZF$ ;	$C_{2x}, \mathcal{T}C_{2y}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Q$ ; $NP$ ;	$C_{2y}, E$ ;	$\{R_5\}, \{R_7\}$ ;	2; $-i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Delta$ ; $\Gamma X$ ;	$C_{2a}, C_{2b}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$U$ ; $ZU$ ;	$C_{2a}, E, C_{2b}\mathcal{T}$ ;	$\{R_5\}, \{R_7\}$ ;	2; $i\sigma_3, \sigma_0, \sigma_0$ ;	C-1 WP; 1
$Y$ ; $XZ/XY$ ;	$C_{2b}, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	C-1 WP; 1

SG 99

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ;	$\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$U$ ; $ZR$ ;	$\sigma_x, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$\Lambda$ ; $\Gamma Z$ ;	$C_{4z}^+, \sigma_y$ ;	$\{R_6\}, \{R_7\}$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ;	DP; 0
$V$ ; $MA$ ;	$C_{4z}^+, \sigma_y$ ;	$\{R_6\}, \{R_7\}$ ;	4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ;	DP; 0
$\Sigma$ ; $\Gamma M$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$S$ ; $ZA$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$Y$ ; $XM$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$T$ ; $RA$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	2; $i\sigma_3, \sigma_0$ ;	P-WNL;

## Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$U$ ; $ZR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ; DP; 0	
$V$ ; $MA$ ; $C_{4z}^+, \sigma_x$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,3}$ ; DP; 0	
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$S$ ; $ZA$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$W$ ; $XR$ ; $\sigma_y, C_{2z}$ ; $\{R_5\}, \{R_6\}$ ; 2; $i\sigma_0, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_3, i\sigma_0$ ; P-WNLs;	
$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_3, -i\sigma_0$ ; P-WNLs;	
$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -i\sigma_3$ ; P-WNL;	
$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_0, -i\sigma_3$ ; P-WNL;	

## SG 101

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ; DP; 0	
$V$ ; MA; $C_{4z}^+, \sigma_y$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ; DP; 0	
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$S$ ; ZA; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$Y$ ; XM; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	

## SG 102

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ; DP; 0	
$V$ ; MA; $C_{4z}^+, \sigma_x$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,3}$ ; DP; 0	
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$S$ ; ZA; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$T$ ; RA; $\sigma_y, E, \mathcal{T}\sigma_x$ ; $\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;	
$W$ ; XR; $\sigma_y, C_{2z}$ ; $\{R_5\}, \{R_6\}$ ; 2; $i\sigma_0, i\sigma_3$ ; P-WNL;	
	$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, i\sigma_3$ ; P-WNL;
	$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_3, i\sigma_0$ ; P-WNLs;
	$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_3, -i\sigma_0$ ; P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -i\sigma_3$ ; P-WNL;
	$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_0, -i\sigma_3$ ; P-WNL;

## SG 103

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ; DP; 0	
$V$ ; MA; $C_{4z}^+, \sigma_y$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ; DP; 0	
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$Y$ ; XM; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	

## SG 104

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ; DP; 0	
$V$ ; $MA$ ; $C_{4z}^+, \sigma_x$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,3}$ ; DP; 0	
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$T$ ; $RA$ ; $\sigma_y, E, \mathcal{T}\sigma_x$ ; $\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;	
$W$ ; $XR$ ; $\sigma_y, C_{2z}$ ; $\{R_5\}, \{R_6\}$ ; 2; $i\sigma_0, i\sigma_3$ ; P-WNL;	
	$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, i\sigma_3$ ; P-WNL;
	$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_3, i\sigma_0$ ; P-WNLs;
	$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_3, -i\sigma_0$ ; P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -i\sigma_3$ ; P-WNL;
	$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_0, -i\sigma_3$ ; P-WNL;

## SG 105

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$U$ ; $ZR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ; DP; 0	
$V$ ; $MA$ ; $C_{4z}^+, \sigma_y$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ; DP; 0	
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$Y$ ; $XM$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$T$ ; $RA$ ; $\sigma_y, \mathcal{T}\sigma_x$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	

## SG 106

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$U$ ; $ZR$ ; $\sigma_x, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ; DP; 0	
$V$ ; $MA$ ; $C_{4z}^+, \sigma_x$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,3}$ ; DP; 0	
$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$W$ ; $XR$ ; $\sigma_y, C_{2z}$ ; $\{R_5\}, \{R_6\}$ ; 2; $i\sigma_0, i\sigma_3$ ; P-WNL;	
	$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, i\sigma_3$ ; P-WNL;
	$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_3, i\sigma_0$ ; P-WNLs;
	$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_3, -i\sigma_0$ ; P-WNLs;
	$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -i\sigma_3$ ; P-WNL;
	$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_0, -i\sigma_3$ ; P-WNL;

## SG 107

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, \sigma_y$ ;	$\{R_6\}, \{R_7\}$ ;	$4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ;	DP;	0
$V$ ; $ZV$ ;	$C_{4z}^+, \sigma_y$ ;	$\{R_6\}, \{R_7\}$ ;	$4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ;	DP;	0
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	
$F$ ; $ZF$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	
$\Delta$ ; $\Gamma X$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	
$U$ ; $ZU$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	
$Y$ ; $XZ/XY$ ;	$\sigma_{da}, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	

## SG 108

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, \sigma_y$ ;	$\{R_6\}, \{R_7\}$ ;	$4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ;	DP;	0
$V$ ; $ZV$ ;	$C_{4z}^+, \sigma_y$ ;	$\{R_6\}, \{R_7\}$ ;	$4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ;	DP;	0
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	
$F$ ; $ZF$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	
$\Delta$ ; $\Gamma X$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	
$U$ ; $ZU$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	
$Y$ ; $XZ/XY$ ;	$\sigma_{da}, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	

## SG 109

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ;	$C_{4z}^+, \sigma_y$ ;	$\{R_6\}, \{R_7\}$ ;	$4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ;	DP;	0
$V$ ; $ZV$ ;	$C_{4z}^+, \sigma_{db}$ ;	$\{R_6\}, \{R_7\}$ ;	$4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,3}$ ;	DP;	0
$W$ ; $XP$ ;	$\sigma_{da}, C_{2z}$ ;	$\{R_5\}, \{R_6\}$ ;	$2; i\sigma_0, i\sigma_3$ ;	P-WNL;	
		$\{R_5\}, \{R_7\}$ ;	$2; i\sigma_3, i\sigma_3$ ;	P-WNL;	
		$\{R_5\}, \{R_8\}$ ;	$2; i\sigma_3, i\sigma_0$ ;	P-WNLs;	
		$\{R_6\}, \{R_7\}$ ;	$2; i\sigma_3, -i\sigma_0$ ;	P-WNLs;	
		$\{R_6\}, \{R_8\}$ ;	$2; i\sigma_3, -i\sigma_3$ ;	P-WNL;	
		$\{R_7\}, \{R_8\}$ ;	$2; -i\sigma_0, -i\sigma_3$ ;	P-WNL;	
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	
$F$ ; $ZF$ ;	$\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	
$\Delta$ ; $\Gamma X$ ;	$\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_2\}, \{R_4\}$ ;	$2; i\sigma_3, \sigma_0$ ;	P-WNL;	

## Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, \sigma_y$ ;	$\{R_6\}, \{R_7\}$ ;	4;	$\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}$ ;	DP;	0
$V$ ; $ZV$ ; $C_{4z}^+, \sigma_{db}$ ;	$\{R_6\}, \{R_7\}$ ;	4;	$\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,3}$ ;	DP;	0
$W$ ; $XP$ ; $\sigma_{da}, C_{2z}$ ;	$\{R_5\}, \{R_6\}$ ;	2;	$i\sigma_0, i\sigma_3$ ;	P-WNL;	
	$\{R_5\}, \{R_7\}$ ;	2;	$i\sigma_3, i\sigma_3$ ;	P-WNL;	
	$\{R_5\}, \{R_8\}$ ;	2;	$i\sigma_3, i\sigma_0$ ;	P-WNLs;	
	$\{R_6\}, \{R_7\}$ ;	2;	$i\sigma_3, -i\sigma_0$ ;	P-WNLs;	
	$\{R_6\}, \{R_8\}$ ;	2;	$i\sigma_3, -i\sigma_3$ ;	P-WNL;	
	$\{R_7\}, \{R_8\}$ ;	2;	$-i\sigma_0, -i\sigma_3$ ;	P-WNL;	
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	2;	$i\sigma_3, \sigma_0$ ;	P-WNL;	
$F$ ; $ZF$ ; $\sigma_y, \mathcal{T}\sigma_x$ ;	$\{R_2\}, \{R_4\}$ ;	2;	$i\sigma_3, \sigma_0$ ;	P-WNL;	
$\Delta$ ; $\Gamma X$ ; $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;	$\{R_2\}, \{R_4\}$ ;	2;	$i\sigma_3, \sigma_0$ ;	P-WNL;	

## SG 111

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma X$ ;  $C_{2y}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $U$ ;  $ZR$ ;  $C_{2y}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma M$ ;  $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $S$ ;  $ZA$ ;  $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $Y$ ;  $XM$ ;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $T$ ;  $RA$ ;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $W$ ;  $XR$ ;  $C_{2z}, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 112

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma X$ ;  $C_{2y}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $U$ ;  $ZR$ ;  $C_{2y}, E, \mathcal{T}C_{2z}$ ;  $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, \sigma_0, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma M$ ;  $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $Y$ ;  $XM$ ;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $T$ ;  $RA$ ;  $C_{2x}, E, \mathcal{T}C_{2y}$ ;  $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, \sigma_0, \sigma_0$ ; C-1 WP; 1  
 $W$ ;  $XR$ ;  $C_{2z}, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 113

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma X$ ;  $C_{2y}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $U$ ;  $ZR$ ;  $C_{2y}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma M$ ;  $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $S$ ;  $ZA$ ;  $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 114

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma X$ ;  $C_{2y}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $U$ ;  $ZR$ ;  $C_{2y}, E, \mathcal{T}C_{2z}$ ;  $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, \sigma_0, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma M$ ;  $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;



## SG 115

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma X$ ;  $\sigma_x, \mathcal{T}\sigma_y$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $U$ ;  $ZR$ ;  $\sigma_x, \mathcal{T}\sigma_y$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Sigma$ ;  $\Gamma M$ ;  $C_{2a}, C_{2b}\mathcal{T}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $S$ ;  $ZA$ ;  $C_{2a}, C_{2b}\mathcal{T}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Y$ ;  $XM$ ;  $\sigma_y, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $T$ ;  $RA$ ;  $\sigma_y, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 116

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma X$ ;  $\sigma_x, \mathcal{T}\sigma_y$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Sigma$ ;  $\Gamma M$ ;  $C_{2a}, C_{2b}\mathcal{T}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $S$ ;  $ZA$ ;  $C_{2a}, E, C_{2b}\mathcal{T}$ ;  $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, \sigma_0, \sigma_0$ ; C-1 WP; 1  
 $Y$ ;  $XM$ ;  $\sigma_y, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 117

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Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma X$ ;  $\sigma_x, \mathcal{T}\sigma_y$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $U$ ;  $ZR$ ;  $\sigma_x, \mathcal{T}\sigma_y$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $\Sigma$ ;  $\Gamma M$ ;  $C_{2a}, C_{2b}\mathcal{T}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $S$ ;  $ZA$ ;  $C_{2a}, C_{2b}\mathcal{T}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $W$ ;  $XR$ ;  $\sigma_y, C_{2z}$ ;  $\{R_5\}, \{R_6\}$ ; 2;  $i\sigma_0, i\sigma_3$ ; P-WNL;  
 $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, i\sigma_3$ ; P-WNL;  
 $\{R_5\}, \{R_8\}$ ; 2;  $i\sigma_3, i\sigma_0$ ; P-WNLs;  
 $\{R_6\}, \{R_7\}$ ; 2;  $i\sigma_3, -i\sigma_0$ ; P-WNLs;  
 $\{R_6\}, \{R_8\}$ ; 2;  $i\sigma_3, -i\sigma_3$ ; P-WNL;  
 $\{R_7\}, \{R_8\}$ ; 2;  $-i\sigma_0, -i\sigma_3$ ; P-WNL;

## SG 118

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $\sigma_x, \mathcal{T}\sigma_y$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$S$ ; $ZA$ ; $C_{2a}, E, C_{2b}\mathcal{T}$ ; $\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ; C-1 WP; 1
$T$ ; $RA$ ; $\sigma_y, E, \mathcal{T}C_{2z}$ ; $\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, \sigma_0, \sigma_0$ ; P-WNL;
$W$ ; $XR$ ; $\sigma_y, C_{2z}$ ; $\{R_5\}, \{R_6\}$ ; 2; $i\sigma_0, i\sigma_3$ ; P-WNL;
$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, i\sigma_3$ ; P-WNL;
$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_3, i\sigma_0$ ; P-WNLs;
$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_3, -i\sigma_0$ ; P-WNLs;
$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -i\sigma_3$ ; P-WNL;
$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_0, -i\sigma_3$ ; P-WNL;

## SG 119

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 Accidental degeneracies on high symmetry line

$W$ ; $XP$ ; $C_{2z}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ; $\sigma_y, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$F$ ; $ZF$ ; $\sigma_y, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\Delta$ ; $\Gamma X$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$U$ ; $ZU$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$Y$ ; $XZ/XY$ ; $C_{2b}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 120

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 Accidental degeneracies on high symmetry line

$W$ ; $XP$ ; $C_{2z}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Sigma$ ; $\Gamma Z/\Gamma\Sigma$ ; $\sigma_y, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$F$ ; $ZF$ ; $\sigma_y, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\Delta$ ; $\Gamma X$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$U$ ; $ZU$ ; $C_{2a}, C_{2b}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$Y$ ; $XZ/XY$ ; $C_{2b}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 121

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 Accidental degeneracies on high symmetry line

$\Sigma$ ;  $\Gamma Z/\Gamma \Sigma$ ;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $F$ ;  $ZF$ ;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $NP$ ;  $C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $\Delta$ ;  $\Gamma X$ ;  $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $U$ ;  $ZU$ ;  $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;  
 $Y$ ;  $XZ/XY$ ;  $\sigma_{da}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 122

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 Accidental degeneracies on high symmetry line

$W$ ;  $XP$ ;  $\sigma_{da}, C_{2z}$ ;  $\{R_5\}, \{R_6\}$ ; 2;  $i\sigma_0, i\sigma_3$ ; P-WNL;  
 $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, i\sigma_3$ ; P-WNL;  
 $\{R_5\}, \{R_8\}$ ; 2;  $i\sigma_3, i\sigma_0$ ; P-WNLs;  
 $\{R_6\}, \{R_7\}$ ; 2;  $i\sigma_3, -i\sigma_0$ ; P-WNLs;  
 $\{R_6\}, \{R_8\}$ ; 2;  $i\sigma_3, -i\sigma_3$ ; P-WNL;  
 $\{R_7\}, \{R_8\}$ ; 2;  $-i\sigma_0, -i\sigma_3$ ; P-WNL;  
 $\Sigma$ ;  $\Gamma Z/\Gamma \Sigma$ ;  $C_{2x}, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $F$ ;  $ZF$ ;  $C_{2x}, E, \mathcal{T}C_{2y}$ ;  $\{R_5\}, \{R_7\}$ ; 2;  $i\sigma_3, \sigma_0, \sigma_0$ ; C-1 WP; 1  
 $Q$ ;  $NP$ ;  $C_{2y}, \bar{E}$ ;  $\{R_{10}\}, \{R_{14}\}$ ; 2;  $i\sigma_3, -\sigma_0$ ; C-1 WP; 1  
 $\Delta$ ;  $\Gamma X$ ;  $\sigma_{db}, \mathcal{T}\sigma_{da}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 123

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 Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma Z$ ;  $C_{4z}^+, \sigma_y, I\mathcal{T}$ ;  $\{R_6\}, \{R_7\}$ ; 4;  $\frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0  
 $V$ ;  $MA$ ;  $C_{4z}^+, \sigma_y, I\mathcal{T}$ ;  $\{R_6\}, \{R_7\}$ ; 4;  $\frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0

## SG 124

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 Accidental degeneracies on high symmetry line

$U$ ;  $ZR$ ;  $\sigma_z, C_{2y}, I\mathcal{T}$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $\Lambda$ ;  $\Gamma Z$ ;  $C_{4z}^+, \sigma_y, I\mathcal{T}$ ;  $\{R_6\}, \{R_7\}$ ; 4;  $\frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0  
 $V$ ;  $MA$ ;  $C_{4z}^+, \sigma_y, I\mathcal{T}$ ;  $\{R_6\}, \{R_7\}$ ; 4;  $\frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0  
 $S$ ;  $ZA$ ;  $\sigma_z, C_{2a}, I\mathcal{T}$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $T$ ;  $RA$ ;  $\sigma_z, C_{2x}, I\mathcal{T}$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 125

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$V$ ; $MA$ ; $C_{4z}^+, \sigma_x, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $-\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0
$Y$ ; $XM$ ; $\sigma_y, C_{2x}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$T$ ; $RA$ ; $\sigma_y, C_{2x}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$W$ ; $XR$ ; $\sigma_y, C_{2z}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 126

Accidental degeneracies on high symmetry line

$U$ ; $ZR$ ; $\sigma_z, C_{2y}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$V$ ; $MA$ ; $C_{4z}^+, \sigma_x, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $-\frac{\Gamma_{0,1}+i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0
$S$ ; $ZA$ ; $\sigma_z, C_{2a}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$Y$ ; $XM$ ; $\sigma_y, C_{2x}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$W$ ; $XR$ ; $\sigma_y, C_{2z}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 127

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$W$ ; $XR$ ; $\sigma_y, C_{2z}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 128

Accidental degeneracies on high symmetry line

$U$ ; $ZR$ ; $\sigma_z, C_{2y}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$S$ ; $ZA$ ; $\sigma_z, C_{2a}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$T$ ; $RA$ ; $C_{2x}, \sigma_y, E, IT$ ; $\{R_6, R_8\}, \{R_7, R_9\}$ ; 4; $-i\Gamma_{0,3}, i\Gamma_{3,0}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;
$W$ ; $XR$ ; $\sigma_y, C_{2z}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;

## SG 129

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$Y$ ; $XM$ ; $C_{2x}, \sigma_y, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;
$T$ ; $RA$ ; $C_{2x}, \sigma_y, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;

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Accidental degeneracies on high symmetry line

$U$ ; ZR;	$\sigma_z, C_{2y}, I\mathcal{T}; \{R_5, R_8\}, \{R_6, R_7\}; 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2};$	DP;	0
$\Lambda$ ; $\Gamma Z$ ;	$C_{4z}^+, \sigma_y, I\mathcal{T}; \{R_6\}, \{R_7\}; 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2};$	DP;	0
$S$ ; ZA;	$\sigma_z, C_{2a}, I\mathcal{T}; \{R_5, R_8\}, \{R_6, R_7\}; 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2};$	DP;	0
$Y$ ; XM;	$C_{2x}, \sigma_y, I\mathcal{T}; \{R_5, R_8\}, \{R_6, R_7\}; 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2};$	P-DNL;	

## 15. SG 131-140

## SG 131

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Lambda; \Gamma Z; C_{4z}^+, \sigma_y, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 V; MA; C_{4z}^+, \sigma_y, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 S; ZA; C_{2a}, \sigma_z, IT; \{R_5, R_6\}, \{R_7, R_8\}; & \quad 4; i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}; \text{DP}; 0
 \end{aligned}$$

## SG 132

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 U; ZR; \sigma_z, C_{2y}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 \Lambda; \Gamma Z; C_{4z}^+, \sigma_y, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 V; MA; C_{4z}^+, \sigma_y, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 T; RA; \sigma_z, C_{2x}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0
 \end{aligned}$$

## SG 133

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Lambda; \Gamma Z; C_{4z}^+, \sigma_y, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 V; MA; C_{4z}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; -\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 S; ZA; C_{2a}, \sigma_z, IT; \{R_5, R_6\}, \{R_7, R_8\}; & \quad 4; i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 Y; XM; \sigma_y, C_{2x}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 T; RA; \sigma_y, C_{2x}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 W; XR; \sigma_y, C_{2z}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0
 \end{aligned}$$

## SG 134

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 U; ZR; \sigma_z, C_{2y}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 \Lambda; \Gamma Z; C_{4z}^+, \sigma_y, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 V; MA; C_{4z}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; -\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 Y; XM; \sigma_y, C_{2x}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 W; XR; \sigma_y, C_{2z}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0
 \end{aligned}$$

## SG 135

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Lambda; \Gamma Z; C_{4z}^+, \sigma_y, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 S; ZA; C_{2a}, \sigma_z, IT; \{R_5, R_6\}, \{R_7, R_8\}; & \quad 4; i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
 W; XR; \sigma_y, C_{2z}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0
 \end{aligned}$$

## SG 136

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Accidental degeneracies on high symmetry line

$U$ ; ZR; $\sigma_z, C_{2y}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$T$ ; RA; $C_{2x}, \sigma_z, \bar{E}, IT$ ; $\{R_6, R_9\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{0,3}, -i\Gamma_{3,3}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;
$W$ ; XR; $\sigma_y, C_{2z}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;

## SG 137

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Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$S$ ; ZA; $C_{2a}, \sigma_z, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0
$Y$ ; XM; $C_{2x}, \sigma_z, IT$ ; $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;
$T$ ; RA; $C_{2x}, \sigma_z, IT$ ; $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;

## SG 138

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Accidental degeneracies on high symmetry line

$U$ ; ZR; $\sigma_z, C_{2y}, IT$ ; $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$\Lambda$ ; $\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$Y$ ; XM; $C_{2x}, \sigma_z, IT$ ; $\{R_5, R_7\}, \{R_6, R_8\}$ ; 4; $i\Gamma_{0,3}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;

## SG 139

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Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$V$ ; ZV; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0

## SG 140

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Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$V$ ; ZV; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$Q$ ; NP; $C_{2y}, IT$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## 16. SG 141-150

## SG 141

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$V$ ; $ZV$ ; $C_{4z}^+, \sigma_x, E, IT$ ; $\{R_{13}\}, \{R_{14}\}$ ; 4; $\frac{\Gamma_{0,2}-i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,1}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0
$W$ ; $XP$ ; $C_{2z}, \sigma_{db}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, \Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0
$U$ ; $ZU$ ; $C_{2a}, \sigma_z, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0
$Y$ ; $XZ/XY$ ; $C_{2b}, \sigma_{da}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0

## SG 142

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_{4z}^+, \sigma_y, IT$ ; $\{R_6\}, \{R_7\}$ ; 4; $\frac{\Gamma_{3,0}+i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ; DP; 0
$V$ ; $ZV$ ; $C_{4z}^+, \sigma_x, E, IT$ ; $\{R_{13}\}, \{R_{14}\}$ ; 4; $\frac{\Gamma_{0,2}-i\Gamma_{3,0}}{\sqrt{2}}, i\Gamma_{0,1}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0
$W$ ; $XP$ ; $C_{2z}, \sigma_{da}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0
$Q$ ; $NP$ ; $C_{2y}, E, IT$ ; $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4; $i\Gamma_{3,0}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0
$U$ ; $ZU$ ; $C_{2a}, \sigma_z, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0
$Y$ ; $XZ/XY$ ; $C_{2b}, \sigma_{da}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; DP; 0

## SG 143

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1
$P$ ; $KH$ ; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1

## SG 144

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1
$P$ ; $KH$ ; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1



## SG 145

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma A; C_3^+; \{R_2\}, \{R_4\}; 2; \sigma_9; & \quad \text{C-1 WP; 1} \\
& \{R_2\}, \{R_6\}; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}; \text{C-1 WP; 1} \\
& \{R_4\}, \{R_6\}; 2; \sigma_{10}; \quad \text{C-1 WP; 1} \\
P; KH; C_3^+; \{R_2\}, \{R_4\}; 2; \sigma_9; & \quad \text{C-1 WP; 1} \\
& \{R_2\}, \{R_6\}; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}; \text{C-1 WP; 1} \\
& \{R_4\}, \{R_6\}; 2; \sigma_{10}; \quad \text{C-1 WP; 1}
\end{aligned}$$

## SG 146

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \Gamma \Lambda / \Gamma Z; C_3^+; \{R_2\}, \{R_4\}; 2; \sigma_9; & \quad \text{C-1 WP; 1} \\
& \{R_2\}, \{R_6\}; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}; \text{C-1 WP; 1} \\
& \{R_4\}, \{R_6\}; 2; \sigma_{10}; \quad \text{C-1 WP; 1} \\
P; ZP; C_3^+; \{R_2\}, \{R_4\}; 2; \sigma_9; & \quad \text{C-1 WP; 1} \\
& \{R_2\}, \{R_6\}; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}; \text{C-1 WP; 1} \\
& \{R_4\}, \{R_6\}; 2; \sigma_{10}; \quad \text{C-1 WP; 1}
\end{aligned}$$

## SG 147

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma A; C_3^+, IT; \{R_2, R_6\}, \{R_4, R_4\}; 4; \Gamma_{12}, -i\Gamma_{0,2}; & \text{DP; 0} \\
P; KH; C_3^+, IT; \{R_2, R_6\}, \{R_4, R_4\}; 4; \Gamma_{12}, -i\Gamma_{0,2}; & \text{DP; 0}
\end{aligned}$$

## SG 148

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \Gamma \Lambda / \Gamma Z; C_3^+, IT; \{R_2, R_6\}, \{R_4, R_4\}; 4; \Gamma_{12}, -i\Gamma_{0,2}; & \text{DP; 0} \\
P; ZP; C_3^+, IT; \{R_2, R_6\}, \{R_4, R_4\}; 4; \Gamma_{12}, -i\Gamma_{0,2}; & \text{DP; 0}
\end{aligned}$$

## SG 149

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma A; C_3^+, C'_{22}\mathcal{T}; \{R_2\}, \{R_4\}; 2; \sigma_9, \sigma_0; & \quad \text{C-1 WP; 1} \\
& \{R_2\}, \{R_6\}; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0; \text{C-1 WP; 1} \\
& \{R_4\}, \{R_6\}; 2; \sigma_{10}, \sigma_0; \quad \text{C-1 WP; 1} \\
P; KH; C_3^+, C'_{22}\mathcal{T}; \{R_2\}, \{R_4\}; 2; \sigma_9, \sigma_0; & \quad \text{C-1 WP; 1} \\
& \{R_2\}, \{R_6\}; 2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0; \text{C-1 WP; 1} \\
& \{R_4\}, \{R_6\}; 2; \sigma_{10}, \sigma_0; \quad \text{C-1 WP; 1} \\
\Sigma; \Gamma M; C'_{21}; \{R_2\}, \{R_4\}; 2; i\sigma_3; & \quad \text{C-1 WP; 1} \\
R; AL; C'_{21}; \{R_2\}, \{R_4\}; 2; i\sigma_3; & \quad \text{C-1 WP; 1}
\end{aligned}$$

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, C_{22}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$P$ ; $KH$ ; $C_3^+$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $C_{22}''$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1
$S$ ; $AH$ ; $C_{22}''$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1
$T'$ ; $MK$ ; $C_{21}''$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1
$S'$ ; $LH$ ; $C_{21}''$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1

## SG 151

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, C'_{22}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$P$ ; $KH$ ; $C_3^+, C'_{22}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$\Sigma$ ; $\Gamma M$ ; $C'_{21}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	
$R$ ; $AL$ ; $C'_{21}$ ; $\{R_2\}, \{R_8\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	

## SG 152

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, C''_{22}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$P$ ; $KH$ ; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1	
$T$ ; $\Gamma K$ ; $C''_{22}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	
$S$ ; $AH$ ; $C''_{22}$ ; $\{R_6\}, \{R_{12}\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	
$T'$ ; $MK$ ; $C''_{21}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	
$S'$ ; $LH$ ; $C''_{21}$ ; $\{R_2\}, \{R_8\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	

## SG 153

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, C'_{22}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$P$ ; $KH$ ; $C_3^+, C'_{22}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$\Sigma$ ; $\Gamma M$ ; $C'_{21}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	
$R$ ; $AL$ ; $C'_{21}$ ; $\{R_6\}, \{R_{12}\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	

SG 154

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, C_{22}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$P$ ; $KH$ ; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1	
$T$ ; $\Gamma K$ ; $C_{22}''$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	
$S$ ; $AH$ ; $C_{22}''$ ; $\{R_2\}, \{R_8\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	
$T'$ ; $MK$ ; $C_{21}''$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	
$S'$ ; $LH$ ; $C_{21}''$ ; $\{R_6\}, \{R_{12}\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	

SG 155

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma \Lambda / \Gamma Z$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$P$ ; $ZP$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$B$ ; $ZB$ ; $C_{21}'$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	
$\Sigma$ ; $\Gamma F / \Gamma \Sigma$ ; $C_{21}'$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	
$Q$ ; $FQ$ ; $C_{23}'$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	
$Y$ ; $LZ / LY$ ; $C_{22}'$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1	

SG 156

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0 + 2\sqrt{3}A_8)}{3}$ ; TP; 0	
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP; 0	
$U$ ; $ML$ ; $\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; P-WNL;	
$P$ ; $KH$ ; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1	
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; P-WNL;	
$R$ ; $AL$ ; $\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; P-WNL;	

## SG 157

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ;	P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ;	TP;	0
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ;	TP;	0
$U$ ; ML; $\sigma_{d1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	
$P$ ; KH; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ;	P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ;	TP;	0
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ;	TP;	0
$T$ ; $\Gamma K$ ; $\sigma_{d2}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	
$S$ ; AH; $\sigma_{d2}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	
$T'$ ; MK; $\sigma_{d1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	
$S'$ ; LH; $\sigma_{d1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	

## SG 158

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ;	P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ;	TP;	0
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ;	TP;	0
$U$ ; ML; $\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	
$P$ ; KH; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ;	C-1 WP;	1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}$ ;	C-1 WP;	1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ;	C-1 WP;	1
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	
$R$ ; AL; $\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	

## SG 159

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ;	P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ;	TP;	0
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ;	TP;	0
$U$ ; ML; $\sigma_{d1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	
$P$ ; KH; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ;	P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ;	TP;	0
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ;	TP;	0
$T$ ; $\Gamma K$ ; $\sigma_{d2}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	
$S$ ; AH; $\sigma_{d2}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	
$T'$ ; MK; $\sigma_{d1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	
$S'$ ; LH; $\sigma_{d1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	P-WNL;	

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;	0
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;	0
$P$ ; $ZP$ ; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;	0
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;	0

## SG 161

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 Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\Lambda/\Gamma Z$ ; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;	0
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;	0
$P$ ; $ZP$ ; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;	0
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;	0

## SG 162

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_3, R_4\}, \{R_6\}$ ; 4; $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_3, R_4\}, \{R_6\}$ ; 4; $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0

## SG 163

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_3, R_4\}, \{R_6\}$ ; 4; $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_3, R_4\}, \{R_6\}$ ; 4; $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0
$R$ ; $AL$ ; $C_{21}', E, IT$ ; $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4; $-i\Gamma_{3,0}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 164

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}, IT$ ; $\{R_3, R_4\}, \{R_6\}$ ; 4; $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0
$P$ ; $KH$ ; $C_3^+, IT$ ; $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4; $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0

## SG 165

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}, IT$ ; $\{R_3, R_4\}, \{R_6\}$ ; 4; $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0
$P$ ; $KH$ ; $C_3^+, IT$ ; $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4; $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0
$S$ ; $AH$ ; $C_{22}'', E, IT$ ; $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4; $-i\Gamma_{3,0}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0
$S'$ ; $LH$ ; $C_{21}'', E, IT$ ; $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4; $-i\Gamma_{3,0}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 166

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 Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma\Lambda/\Gamma Z$ ;  $C_3^+, \sigma_{d1}, IT$ ;  $\{R_3, R_4\}, \{R_6\}$ ; 4;  $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0  
 $P$ ; ZP;  $C_3^+, \sigma_{d1}, IT$ ;  $\{R_3, R_4\}, \{R_6\}$ ; 4;  $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0

## SG 167

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 Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma\Lambda/\Gamma Z$ ;  $C_3^+, \sigma_{d1}, IT$ ;  $\{R_3, R_4\}, \{R_6\}$ ; 4;  $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0  
 $P$ ; ZP;  $C_3^+, \sigma_{d1}, IT$ ;  $\{R_3, R_4\}, \{R_6\}$ ; 4;  $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ; DP; 0  
 $B$ ; ZB;  $C_{21}', E, IT$ ;  $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $i\Gamma_{3,0}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $Y$ ; LZ/LY;  $C_{22}', E, IT$ ;  $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $-i\Gamma_{3,0}, \Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 168

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 Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma A$ ;  $C_6^+$ ;  $\{R_2\}, \{R_{10}\}$ ; 2;  $\sigma_{12}$ ; C-2 WP; 2  
 $\{R_2\}, \{R_{12}\}$ ; 2;  $\frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}$ ; C-1 WP; 1  
 $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_{11}$ ; C-1 WP; 1  
 $\{R_2\}, \{R_6\}$ ; 2;  $\frac{\sqrt{3}\sigma_3 + i\sigma_0}{2}$ ; C-2 WP; 2  
 $\{R_2\}, \{R_8\}$ ; 2;  $\sqrt[6]{-1}\sigma_3$ ; C-3 WP; 3  
 $\{R_4\}, \{R_{10}\}$ ; 2;  $i\sigma_3$ ; C-3 WP; 3  
 $\{R_4\}, \{R_{12}\}$ ; 2;  $\sigma_{15}$ ; C-2 WP; 2  
 $\{R_4\}, \{R_6\}$ ; 2;  $\sigma_{13}$ ; C-1 WP; 1  
 $\{R_4\}, \{R_8\}$ ; 2;  $\sigma_{14}$ ; C-2 WP; 2  
 $\{R_6\}, \{R_{10}\}$ ; 2;  $\sigma_{16}$ ; C-2 WP; 2  
 $\{R_6\}, \{R_{12}\}$ ; 2;  $(-1)^{5/6}\sigma_3$ ; C-3 WP; 3  
 $\{R_6\}, \{R_8\}$ ; 2;  $\frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}$ ; C-1 WP; 1  
 $\{R_8\}, \{R_{10}\}$ ; 2;  $\sigma_{17}$ ; C-1 WP; 1  
 $\{R_8\}, \{R_{12}\}$ ; 2;  $\frac{i(\sigma_0 - i\sqrt{3}\sigma_3)}{-2}$ ; C-2 WP; 2  
 $\{R_{10}\}, \{R_{12}\}$ ; 2;  $\sigma_{18}$ ; C-1 WP; 1  
 $U$ ; ML;  $C_2$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3$ ; C-1 WP; 1  
 $P$ ; KH;  $C_3^+$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_9$ ; C-1 WP; 1  
 $\{R_2\}, \{R_6\}$ ; 2;  $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1  
 $\{R_4\}, \{R_6\}$ ; 2;  $\sigma_{10}$ ; C-1 WP; 1



SG 169

Accidental degeneracies on high symmetry line

$\Delta; \Gamma A; C_6^+; \{R_2\}, \{R_{10}\};$	$2; \sigma_{12};$	C-2 WP; 2
$\{R_2\}, \{R_{12}\};$	$2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2};$	C-1 WP; 1
$\{R_2\}, \{R_4\};$	$2; \sigma_{11};$	C-1 WP; 1
$\{R_2\}, \{R_6\};$	$2; \frac{\sqrt{3}\sigma_3+i\sigma_0}{2};$	C-2 WP; 2
$\{R_2\}, \{R_8\};$	$2; \sqrt[6]{-1}\sigma_3;$	C-3 WP; 3
$\{R_4\}, \{R_{10}\};$	$2; i\sigma_3;$	C-3 WP; 3
$\{R_4\}, \{R_{12}\};$	$2; \sigma_{15};$	C-2 WP; 2
$\{R_4\}, \{R_6\};$	$2; \sigma_{13};$	C-1 WP; 1
$\{R_4\}, \{R_8\};$	$2; \sigma_{14};$	C-2 WP; 2
$\{R_6\}, \{R_{10}\};$	$2; \sigma_{16};$	C-2 WP; 2
$\{R_6\}, \{R_{12}\};$	$2; (-1)^{5/6}\sigma_3;$	C-3 WP; 3
$\{R_6\}, \{R_8\};$	$2; \frac{-\sqrt{3}\sigma_0+i\sigma_3}{2};$	C-1 WP; 1
$\{R_8\}, \{R_{10}\};$	$2; \sigma_{17};$	C-1 WP; 1
$\{R_8\}, \{R_{12}\};$	$2; \frac{i(\sigma_0-i\sqrt{3}\sigma_3)}{-2};$	C-2 WP; 2
$\{R_{10}\}, \{R_{12}\};$	$2; \sigma_{18};$	C-1 WP; 1
$U; ML; C_2; \{R_2\}, \{R_4\};$	$2; i\sigma_3;$	C-1 WP; 1
$P; KH; C_3^+; \{R_2\}, \{R_4\};$	$2; \sigma_9;$	C-1 WP; 1
$\{R_2\}, \{R_6\};$	$2; \frac{\sigma_0+i\sqrt{3}\sigma_3}{2};$	C-1 WP; 1
$\{R_4\}, \{R_6\};$	$2; \sigma_{10};$	C-1 WP; 1

SG 170

Accidental degeneracies on high symmetry line

$\Delta; \Gamma A; C_6^+; \{R_2\}, \{R_{10}\};$	$2; \sigma_{12};$	C-2 WP; 2
$\{R_2\}, \{R_{12}\};$	$2; \frac{\sqrt{3}\sigma_0+i\sigma_3}{2};$	C-1 WP; 1
$\{R_2\}, \{R_4\};$	$2; \sigma_{11};$	C-1 WP; 1
$\{R_2\}, \{R_6\};$	$2; \frac{\sqrt{3}\sigma_3+i\sigma_0}{2};$	C-2 WP; 2
$\{R_2\}, \{R_8\};$	$2; \sqrt[6]{-1}\sigma_3;$	C-3 WP; 3
$\{R_4\}, \{R_{10}\};$	$2; i\sigma_3;$	C-3 WP; 3
$\{R_4\}, \{R_{12}\};$	$2; \sigma_{15};$	C-2 WP; 2
$\{R_4\}, \{R_6\};$	$2; \sigma_{13};$	C-1 WP; 1
$\{R_4\}, \{R_8\};$	$2; \sigma_{14};$	C-2 WP; 2
$\{R_6\}, \{R_{10}\};$	$2; \sigma_{16};$	C-2 WP; 2
$\{R_6\}, \{R_{12}\};$	$2; (-1)^{5/6}\sigma_3;$	C-3 WP; 3
$\{R_6\}, \{R_8\};$	$2; \frac{-\sqrt{3}\sigma_0+i\sigma_3}{2};$	C-1 WP; 1
$\{R_8\}, \{R_{10}\};$	$2; \sigma_{17};$	C-1 WP; 1
$\{R_8\}, \{R_{12}\};$	$2; \frac{i(\sigma_0-i\sqrt{3}\sigma_3)}{-2};$	C-2 WP; 2
$\{R_{10}\}, \{R_{12}\};$	$2; \sigma_{18};$	C-1 WP; 1
$U; ML; C_2; \{R_2\}, \{R_4\};$	$2; i\sigma_3;$	C-1 WP; 1
$P; KH; C_3^+; \{R_2\}, \{R_4\};$	$2; \sigma_9;$	C-1 WP; 1
$\{R_2\}, \{R_6\};$	$2; \frac{\sigma_0+i\sqrt{3}\sigma_3}{2};$	C-1 WP; 1
$\{R_4\}, \{R_6\};$	$2; \sigma_{10};$	C-1 WP; 1

SG 171

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+$ ; $\{R_2\}, \{R_{10}\}$ ; 2; $\sigma_{12}$ ;	C-2 WP; 2
$\{R_2\}, \{R_{12}\}$ ; 2; $\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}$ ;	C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_{11}$ ;	C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sqrt{3}\sigma_3+i\sigma_0}{2}$ ;	C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\sqrt[6]{-1}\sigma_3$ ;	C-3 WP; 3
$\{R_4\}, \{R_{10}\}$ ; 2; $i\sigma_3$ ;	C-3 WP; 3
$\{R_4\}, \{R_{12}\}$ ; 2; $\sigma_{15}$ ;	C-2 WP; 2
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{13}$ ;	C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $\sigma_{14}$ ;	C-2 WP; 2
$\{R_6\}, \{R_{10}\}$ ; 2; $\sigma_{16}$ ;	C-2 WP; 2
$\{R_6\}, \{R_{12}\}$ ; 2; $(-1)^{5/6}\sigma_3$ ;	C-3 WP; 3
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}$ ;	C-1 WP; 1
$\{R_8\}, \{R_{10}\}$ ; 2; $\sigma_{17}$ ;	C-1 WP; 1
$\{R_8\}, \{R_{12}\}$ ; 2; $\frac{i(\sigma_0-i\sqrt{3}\sigma_3)}{-2}$ ;	C-2 WP; 2
$\{R_{10}\}, \{R_{12}\}$ ; 2; $\sigma_{18}$ ;	C-1 WP; 1
$U$ ; ML; $C_2$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	C-1 WP; 1
$P$ ; KH; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ;	C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ;	C-1 WP; 1

SG 172

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+$ ; $\{R_2\}, \{R_{10}\}$ ; 2; $\sigma_{12}$ ; C-2 WP; 2
$\{R_2\}, \{R_{12}\}$ ; 2; $\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}$ ; C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_{11}$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sqrt{3}\sigma_3+i\sigma_0}{2}$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\sqrt[6]{-1}\sigma_3$ ; C-3 WP; 3
$\{R_4\}, \{R_{10}\}$ ; 2; $i\sigma_3$ ; C-3 WP; 3
$\{R_4\}, \{R_{12}\}$ ; 2; $\sigma_{15}$ ; C-2 WP; 2
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{13}$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $\sigma_{14}$ ; C-2 WP; 2
$\{R_6\}, \{R_{10}\}$ ; 2; $\sigma_{16}$ ; C-2 WP; 2
$\{R_6\}, \{R_{12}\}$ ; 2; $(-1)^{5/6}\sigma_3$ ; C-3 WP; 3
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}$ ; C-1 WP; 1
$\{R_8\}, \{R_{10}\}$ ; 2; $\sigma_{17}$ ; C-1 WP; 1
$\{R_8\}, \{R_{12}\}$ ; 2; $\frac{i(\sigma_0-i\sqrt{3}\sigma_3)}{-2}$ ; C-2 WP; 2
$\{R_{10}\}, \{R_{12}\}$ ; 2; $\sigma_{18}$ ; C-1 WP; 1
$U$ ; $ML$ ; $C_2$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1
$P$ ; $KH$ ; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1

SG 173

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+$ ; $\{R_2\}, \{R_{10}\}$ ; 2; $\sigma_{12}$ ; C-2 WP; 2
$\{R_2\}, \{R_{12}\}$ ; 2; $\frac{\sqrt{3}\sigma_0+i\sigma_3}{2}$ ; C-1 WP; 1
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_{11}$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sqrt{3}\sigma_3+i\sigma_0}{2}$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\sqrt[6]{-1}\sigma_3$ ; C-3 WP; 3
$\{R_4\}, \{R_{10}\}$ ; 2; $i\sigma_3$ ; C-3 WP; 3
$\{R_4\}, \{R_{12}\}$ ; 2; $\sigma_{15}$ ; C-2 WP; 2
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{13}$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $\sigma_{14}$ ; C-2 WP; 2
$\{R_6\}, \{R_{10}\}$ ; 2; $\sigma_{16}$ ; C-2 WP; 2
$\{R_6\}, \{R_{12}\}$ ; 2; $(-1)^{5/6}\sigma_3$ ; C-3 WP; 3
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sqrt{3}\sigma_0+i\sigma_3}{2}$ ; C-1 WP; 1
$\{R_8\}, \{R_{10}\}$ ; 2; $\sigma_{17}$ ; C-1 WP; 1
$\{R_8\}, \{R_{12}\}$ ; 2; $\frac{i(\sigma_0-i\sqrt{3}\sigma_3)}{-2}$ ; C-2 WP; 2
$\{R_{10}\}, \{R_{12}\}$ ; 2; $\sigma_{18}$ ; C-1 WP; 1
$U$ ; $ML$ ; $C_2$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1
$P$ ; $KH$ ; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1

SG 174

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, S_3^+ \mathcal{T}$ ; $\{R_2, R_6\}, \{R_4\}$ ; 3; $\frac{\sqrt{3}(A_8 + iA_5)}{2}, A_{25}$ ; TP; 0	
$P$ ; KH; $C_3^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1	
$T$ ; $\Gamma K$ ; $\sigma_h$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; P-WNL;	
$S$ ; AH; $\sigma_h$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; P-WNL;	
$T'$ ; MK; $\sigma_h$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; P-WNL;	
$S'$ ; LH; $\sigma_h$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; P-WNL;	
$\Sigma$ ; $\Gamma M$ ; $\sigma_h$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; P-WNL;	
$R$ ; AL; $\sigma_h$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; P-WNL;	

SG 175

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, I\mathcal{T}$ ; $\{R_2, R_{12}\}, \{R_4, R_{10}\}$ ; 4; $\Gamma_{14}, -i\Gamma_{0,2}$ ; DP; 0	
$\{R_2, R_{12}\}, \{R_6, R_8\}$ ; 4; $\frac{\sqrt{3}\Gamma_{3,0} + i\Gamma_{0,3}}{2}, -i\Gamma_{0,2}$ ; QDP; 0	
$\{R_4, R_{10}\}, \{R_6, R_8\}$ ; 4; $\Gamma_{15}, -i\Gamma_{0,2}$ ; DP; 0	
$P$ ; KH; $C_3^+, I\mathcal{T}$ ; $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4; $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0	

SG 176

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, I\mathcal{T}$ ; $\{R_2, R_{12}\}, \{R_4, R_{10}\}$ ; 4; $\Gamma_{14}, -i\Gamma_{0,2}$ ; DP; 0	
$\{R_2, R_{12}\}, \{R_6, R_8\}$ ; 4; $\frac{\sqrt{3}\Gamma_{3,0} + i\Gamma_{0,3}}{2}, -i\Gamma_{0,2}$ ; QDP; 0	
$\{R_4, R_{10}\}, \{R_6, R_8\}$ ; 4; $\Gamma_{15}, -i\Gamma_{0,2}$ ; DP; 0	
$P$ ; KH; $C_3^+, I\mathcal{T}$ ; $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4; $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0	
$S$ ; AH; $\sigma_h, I\mathcal{T}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$S'$ ; LH; $\sigma_h, I\mathcal{T}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;	
$R$ ; AL; $\sigma_h, I\mathcal{T}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; P-DNL;	

$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_2\}, \{R_{10}\}$ ; 2; $\sigma_{12}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_{12}\}$ ; 2; $\frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_{11}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sqrt{3}\sigma_3 + i\sigma_0}{2}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\sqrt[6]{-1}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{10}\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{12}\}$ ; 2; $\sigma_{15}, \sigma_0$ ; C-2 WP; 2	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{13}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $\sigma_{14}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{10}\}$ ; 2; $\sigma_{16}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{12}\}$ ; 2; $(-1)^{5/6}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{10}\}$ ; 2; $\sigma_{17}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{12}\}$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2i}, \sigma_0$ ; C-2 WP; 2	
$\{R_{10}\}, \{R_{12}\}$ ; 2; $\sigma_{18}, \sigma_0$ ; C-1 WP; 1	
$U$ ; ML; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$P$ ; KH; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$S$ ; AH; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$T'$ ; MK; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$S'$ ; LH; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$R$ ; AL; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	

$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_2\}, \{R_{10}\}$ ; 2; $\sigma_{12}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_{12}\}$ ; 2; $\frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_{11}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sqrt{3}\sigma_3 + i\sigma_0}{2}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\sqrt[6]{-1}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{10}\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{12}\}$ ; 2; $\sigma_{15}, \sigma_0$ ; C-2 WP; 2	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{13}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $\sigma_{14}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{10}\}$ ; 2; $\sigma_{16}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{12}\}$ ; 2; $(-1)^{5/6}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{10}\}$ ; 2; $\sigma_{17}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{12}\}$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2i}, \sigma_0$ ; C-2 WP; 2	
$\{R_{10}\}, \{R_{12}\}$ ; 2; $\sigma_{18}, \sigma_0$ ; C-1 WP; 1	
$U$ ; $ML$ ; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$P$ ; $KH$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$T'$ ; $MK$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	

$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_2\}, \{R_{10}\}$ ; 2; $\sigma_{12}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_{12}\}$ ; 2; $\frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_{11}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sqrt{3}\sigma_3 + i\sigma_0}{2}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\sqrt[6]{-1}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{10}\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{12}\}$ ; 2; $\sigma_{15}, \sigma_0$ ; C-2 WP; 2	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{13}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $\sigma_{14}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{10}\}$ ; 2; $\sigma_{16}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{12}\}$ ; 2; $(-1)^{5/6}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{10}\}$ ; 2; $\sigma_{17}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{12}\}$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2i}, \sigma_0$ ; C-2 WP; 2	
$\{R_{10}\}, \{R_{12}\}$ ; 2; $\sigma_{18}, \sigma_0$ ; C-1 WP; 1	
$U$ ; ML; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$P$ ; KH; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$T'$ ; MK; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	

$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_2\}, \{R_{10}\}$ ; 2; $\sigma_{12}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_{12}\}$ ; 2; $\frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_{11}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sqrt{3}\sigma_3 + i\sigma_0}{2}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\sqrt[6]{-1}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{10}\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{12}\}$ ; 2; $\sigma_{15}, \sigma_0$ ; C-2 WP; 2	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{13}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $\sigma_{14}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{10}\}$ ; 2; $\sigma_{16}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{12}\}$ ; 2; $(-1)^{5/6}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{10}\}$ ; 2; $\sigma_{17}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{12}\}$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2i}, \sigma_0$ ; C-2 WP; 2	
$\{R_{10}\}, \{R_{12}\}$ ; 2; $\sigma_{18}, \sigma_0$ ; C-1 WP; 1	
$U$ ; $ML$ ; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$P$ ; $KH$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$S$ ; $AH$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_6\}, \{R_{12}\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$T'$ ; $MK$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$S'$ ; $LH$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$R$ ; $AL$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	



## SG 181

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Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_2\}, \{R_{10}\}$ ; 2; $\sigma_{12}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_{12}\}$ ; 2; $\frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_{11}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sqrt{3}\sigma_3 + i\sigma_0}{2}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\sqrt[6]{-1}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{10}\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{12}\}$ ; 2; $\sigma_{15}, \sigma_0$ ; C-2 WP; 2	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{13}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $\sigma_{14}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{10}\}$ ; 2; $\sigma_{16}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{12}\}$ ; 2; $(-1)^{5/6}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{10}\}$ ; 2; $\sigma_{17}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{12}\}$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2i}, \sigma_0$ ; C-2 WP; 2	
$\{R_{10}\}, \{R_{12}\}$ ; 2; $\sigma_{18}, \sigma_0$ ; C-1 WP; 1	
$U$ ; $ML$ ; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$P$ ; $KH$ ; $C_3^+, C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$S$ ; $AH$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$T'$ ; $MK$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$S'$ ; $LH$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$R$ ; $AL$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	

SG 182

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, C_{23}'' \mathcal{T}$ ; $\{R_2\}, \{R_{10}\}$ ; 2; $\sigma_{12}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_{12}\}$ ; 2; $\frac{\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_4\}$ ; 2; $\sigma_{11}, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sqrt{3}\sigma_3 + i\sigma_0}{2}, \sigma_0$ ; C-2 WP; 2	
$\{R_2\}, \{R_8\}$ ; 2; $\sqrt[6]{-1}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{10}\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_4\}, \{R_{12}\}$ ; 2; $\sigma_{15}, \sigma_0$ ; C-2 WP; 2	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{13}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_8\}$ ; 2; $\sigma_{14}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{10}\}$ ; 2; $\sigma_{16}, \sigma_0$ ; C-2 WP; 2	
$\{R_6\}, \{R_{12}\}$ ; 2; $(-1)^{5/6}\sigma_3, \sigma_0$ ; C-3 WP; 3	
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sqrt{3}\sigma_0 + i\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{10}\}$ ; 2; $\sigma_{17}, \sigma_0$ ; C-1 WP; 1	
$\{R_8\}, \{R_{12}\}$ ; 2; $\frac{\sigma_0 - i\sqrt{3}\sigma_3}{2i}, \sigma_0$ ; C-2 WP; 2	
$\{R_{10}\}, \{R_{12}\}$ ; 2; $\sigma_{18}, \sigma_0$ ; C-1 WP; 1	
$U$ ; $ML$ ; $C_2, C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$P$ ; $KH$ ; $C_3^+, C_{22}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1	
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1	
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1	
$T$ ; $\Gamma K$ ; $C_{22}'', C_{22}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$T'$ ; $MK$ ; $C_{21}'', C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	
$\Sigma$ ; $\Gamma M$ ; $C_{21}', C_{21}'' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1	

SG 183

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{d1}$ ; $\{R_7\}, \{R_8\}$ ; 4; $\Gamma_{16}, i\Gamma_{0,1}$ ; DP; 0	
$\{R_7\}, \{R_9\}$ ; 4; $\Gamma_{15}, i\Gamma_{0,1}$ ; DP; 0	
$\{R_8\}, \{R_9\}$ ; 4; $\frac{\sqrt{3}\Gamma_{3,0} + i\Gamma_{0,3}}{2}, i\Gamma_{0,1}$ ; DP; 0	
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0 + 2\sqrt{3}A_8)}{3}$ ; TP;	
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;	
$T$ ; $\Gamma K$ ; $\sigma_{d2}, C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$S$ ; $AH$ ; $\sigma_{d2}, C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$T'$ ; $MK$ ; $\sigma_{d1}, \mathcal{T}\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$S'$ ; $LH$ ; $\sigma_{d1}, \mathcal{T}\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}, C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$R$ ; $AL$ ; $\sigma_{v1}, C_2 \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	

## SG 184

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{d1}$ ; $\{R_7\}, \{R_8\}$ ; 4; $\Gamma_{16}, i\Gamma_{0,1}$ ; DP; 0
$\{R_7\}, \{R_9\}$ ; 4; $\Gamma_{15}, i\Gamma_{0,1}$ ; DP; 0
$\{R_8\}, \{R_9\}$ ; 4; $\frac{\sqrt{3}\Gamma_{3,0}+i\Gamma_{0,3}}{2}, i\Gamma_{0,1}$ ; DP; 0
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;
$T$ ; $\Gamma K$ ; $\sigma_{d2}, C_2\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$T'$ ; $MK$ ; $\sigma_{d1}, \mathcal{T}\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}, C_2\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 185

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{d1}$ ; $\{R_7\}, \{R_8\}$ ; 4; $\Gamma_{16}, i\Gamma_{0,1}$ ; DP; 0
$\{R_7\}, \{R_9\}$ ; 4; $\Gamma_{15}, i\Gamma_{0,1}$ ; DP; 0
$\{R_8\}, \{R_9\}$ ; 4; $\frac{\sqrt{3}\Gamma_{3,0}+i\Gamma_{0,3}}{2}, i\Gamma_{0,1}$ ; DP; 0
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;
$T$ ; $\Gamma K$ ; $\sigma_{d2}, C_2\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$S$ ; $AH$ ; $\sigma_{d2}, C_2\mathcal{T}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$T'$ ; $MK$ ; $\sigma_{d1}, \mathcal{T}\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$S'$ ; $LH$ ; $\sigma_{d1}, \mathcal{T}\sigma_{v1}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}, C_2\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;

## SG 186

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{d1}$ ; $\{R_7\}, \{R_8\}$ ; 4; $\Gamma_{16}, i\Gamma_{0,1}$ ; DP; 0
$\{R_7\}, \{R_9\}$ ; 4; $\Gamma_{15}, i\Gamma_{0,1}$ ; DP; 0
$\{R_8\}, \{R_9\}$ ; 4; $\frac{\sqrt{3}\Gamma_{3,0}+i\Gamma_{0,3}}{2}, i\Gamma_{0,1}$ ; DP; 0
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;
$T$ ; $\Gamma K$ ; $\sigma_{d2}, C_2\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$T'$ ; $MK$ ; $\sigma_{d1}, \mathcal{T}\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\Sigma$ ; $\Gamma M$ ; $\sigma_{v1}, C_2\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$R$ ; $AL$ ; $\sigma_{v1}, C_2\mathcal{T}$ ; $\{R_2, R_2\}, \{R_4, R_4\}$ ; 4; $i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

SG 187

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}, S_3^+ \mathcal{T}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}, -A_{24}$ ;	TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}, -A_{24}$ ;	TP;
$U$ ; ML; $\sigma_{v1}, \mathcal{T}\sigma_h$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$P$ ; KH; $C_3^+, C_{23}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $\sigma_h, \mathcal{T}\sigma_{v2}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$S$ ; AH; $\sigma_h, \mathcal{T}\sigma_{v2}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$T'$ ; MK; $\sigma_h, \mathcal{T}\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$S'$ ; LH; $\sigma_h, \mathcal{T}\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	P-WNL;

SG 188

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}, S_3^+ \mathcal{T}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3, \sigma_0$ ;	P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}, -A_{24}$ ;	TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}, -A_{24}$ ;	TP;
$U$ ; ML; $\sigma_{v1}, \mathcal{T}\sigma_h$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$P$ ; KH; $C_3^+, C_{23}' \mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ;	C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ;	C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$T$ ; $\Gamma K$ ; $\sigma_h, \mathcal{T}\sigma_{v2}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$T'$ ; MK; $\sigma_h, \mathcal{T}\sigma_{v1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	P-WNL;
$R$ ; AL; $C_{21}', \sigma_h$ ; $\{R_5\}, \{R_6\}$ ; 2; $i\sigma_0, i\sigma_3$ ;	P-WNLs;
$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, i\sigma_3$ ;	P-WNL;
$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_3, i\sigma_0$ ;	P-WNL;
$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_3, -i\sigma_0$ ;	P-WNL;
$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -i\sigma_3$ ;	P-WNL;
$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_0, -i\sigma_3$ ;	P-WNLs;

SG 189

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}, S_3^+ \mathcal{T}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3, \sigma_0$ ; P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}, -A_{24}$ ; TP;	
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}, -A_{24}$ ; TP;	
$U$ ; ML; $\sigma_{d1}, \mathcal{T}\sigma_h$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$P$ ; KH; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;	
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;	
$\Sigma$ ; $\Gamma M$ ; $\sigma_h, \mathcal{T}\sigma_{d1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$R$ ; AL; $\sigma_h, \mathcal{T}\sigma_{d1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	

SG 190

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_3^+, \sigma_{v1}, S_3^+ \mathcal{T}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3, \sigma_0$ ; P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}, -A_{24}$ ; TP;	
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}, -A_{24}$ ; TP;	
$U$ ; ML; $\sigma_{d1}, \mathcal{T}\sigma_h$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	
$P$ ; KH; $C_3^+, \sigma_{d1}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;	
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;	
$S$ ; AH; $C_{22}'', \sigma_h$ ; $\{R_5\}, \{R_6\}$ ; 2; $i\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_3, i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_3, -i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -i\sigma_3$ ; P-WNL;	
$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_0, -i\sigma_3$ ; P-WNLs;	
$S'$ ; LH; $C_{21}'', \sigma_h$ ; $\{R_5\}, \{R_6\}$ ; 2; $i\sigma_0, i\sigma_3$ ; P-WNLs;	
$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, i\sigma_3$ ; P-WNL;	
$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_3, i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_3, -i\sigma_0$ ; P-WNL;	
$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -i\sigma_3$ ; P-WNL;	
$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_0, -i\sigma_3$ ; P-WNLs;	
$\Sigma$ ; $\Gamma M$ ; $\sigma_h, \mathcal{T}\sigma_{d1}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;	

## SG 191

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{d1}, IT$ ; $\{R_7\}, \{R_8\}$ ;	4; $\Gamma_{16}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	DP; 0
$\{R_7\}, \{R_9\}$ ;	4; $\Gamma_{15}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	DP; 0
$\{R_8\}, \{R_9\}$ ;	4; $\frac{\sqrt{3}\Gamma_{3,0}+i\Gamma_{0,3}}{2}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	QDP; 0
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_3, R_4\}, \{R_6\}$ ;	4; $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ;	DP; 0

## SG 192

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{d1}, IT$ ; $\{R_7\}, \{R_8\}$ ;	4; $\Gamma_{16}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	DP; 0
$\{R_7\}, \{R_9\}$ ;	4; $\Gamma_{15}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	DP; 0
$\{R_8\}, \{R_9\}$ ;	4; $\frac{\sqrt{3}\Gamma_{3,0}+i\Gamma_{0,3}}{2}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	QDP; 0
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_3, R_4\}, \{R_6\}$ ;	4; $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ;	DP; 0
$S$ ; $AH$ ; $C_{22}^{\prime\prime}, \sigma_h, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ;	4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ;	DP; 0
$S'$ ; $LH$ ; $C_{21}^{\prime\prime}, \sigma_h, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ;	4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ;	DP; 0
$R$ ; $AL$ ; $C_{21}^{\prime}, \sigma_h, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ;	4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ;	DP; 0

## SG 193

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{d1}, IT$ ; $\{R_7\}, \{R_8\}$ ;	4; $\Gamma_{16}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	DP; 0
$\{R_7\}, \{R_9\}$ ;	4; $\Gamma_{15}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	DP; 0
$\{R_8\}, \{R_9\}$ ;	4; $\frac{\sqrt{3}\Gamma_{3,0}+i\Gamma_{0,3}}{2}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	QDP; 0
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_3, R_4\}, \{R_6\}$ ;	4; $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ;	DP; 0
$R$ ; $AL$ ; $\sigma_h, C_{21}^{\prime}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ;	4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ;	P-DNL;

## SG 194

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma A$ ; $C_6^+, \sigma_{d1}, IT$ ; $\{R_7\}, \{R_8\}$ ;	4; $\Gamma_{16}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	DP; 0
$\{R_7\}, \{R_9\}$ ;	4; $\Gamma_{15}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	DP; 0
$\{R_8\}, \{R_9\}$ ;	4; $\frac{\sqrt{3}\Gamma_{3,0}+i\Gamma_{0,3}}{2}, i\Gamma_{0,1}, -i\Gamma_{0,2}$ ;	QDP; 0
$P$ ; $KH$ ; $C_3^+, \sigma_{d1}, IT$ ; $\{R_3, R_4\}, \{R_6\}$ ;	4; $\Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}$ ;	DP; 0
$S$ ; $AH$ ; $\sigma_h, C_{22}^{\prime\prime}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ;	4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ;	P-DNL;
$S'$ ; $LH$ ; $\sigma_h, C_{21}^{\prime\prime}, IT$ ; $\{R_5, R_6\}, \{R_7, R_8\}$ ;	4; $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ;	P-DNL;

## SG 195

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma R$ ; $C_{31}^-$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1
$Z$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$T$ ; $MR$ ; $C_{2z}, \mathcal{T}C_{2x}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 196

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma L$ ; $C_{31}^-$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1
$Z$ ; $XW$ ; $C_{2x}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 197

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma H$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma P$ ; $C_{31}^-$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1
$D$ ; $NP$ ; $C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ; C-1 WP; 1
$F$ ; $PH$ ; $C_{34}^+$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1

## SG 198

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 Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma R$ ; $C_{31}^-$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1
$T$ ; $MR$ ; $C_{2z}, \bar{E}, \mathcal{T}C_{2x}$ ; $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4; $-i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; C-2 DP; 2

SG 199

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma\text{H}$ ; $C_{2y}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma\text{P}$ ; $C_{31}^-$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}$ ; C-1 WP; 1
$D$ ; $\text{NP}$ ; $C_{2z}, \bar{E}$ ; $\{R_5\}, \{R_7\}$ ; 2; $-i\sigma_3, -\sigma_0$ ; C-1 WP; 1
$F$ ; $\text{PH}$ ; $C_{34}^+, \bar{E}$ ; $\{R_7\}, \{R_{11}\}$ ; 2; $\sigma_{20}, -\sigma_0$ ; C-1 WP; 1
$\{R_7\}, \{R_9\}$ ; 2; $\sigma_{19}, -\sigma_0$ ; C-1 WP; 1
$\{R_9\}, \{R_{11}\}$ ; 2; $\frac{\sqrt{3}\sigma_3 + i\sigma_0}{2}, -\sigma_0$ ; C-1 WP; 1

SG 200

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\text{R}$ ; $C_{31}^-, IT$ ; $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4; $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0
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## SG 201

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma R$ ;  $C_{31}^-, IT$ ;  $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4;  $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0  
 $Z$ ;  $XM$ ;  $\sigma_y, C_{2x}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 202

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma L$ ;  $C_{31}^-, IT$ ;  $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4;  $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0

## SG 203

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma L$ ;  $C_{31}^-, IT$ ;  $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4;  $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0  
 $Z$ ;  $XW$ ;  $\sigma_y, C_{2x}, IT$ ;  $\{R_5, R_8\}, \{R_6, R_7\}$ ; 4;  $i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}$ ; DP; 0

## SG 204

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma P$ ;  $C_{31}^-, IT$ ;  $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4;  $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0  
 $F$ ;  $PH$ ;  $C_{34}^+, IT$ ;  $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4;  $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0

## SG 205

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Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma R$ ;  $C_{31}^-, IT$ ;  $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4;  $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0  
 $S$ ;  $XR$ ;  $\sigma_y, \bar{E}, IT$ ;  $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $-i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $T$ ;  $MR$ ;  $\sigma_x, \sigma_y, \bar{E}, IT$ ;  $\{R_6, R_6\}, \{R_7, R_7\}$ ; 4;  $-\Gamma_{0,0}, -i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $\{R_6, R_6\}, \{R_8, R_8\}$ ; 4;  $-\Gamma_{3,0}, -i\Gamma_{0,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $\{R_6, R_6\}, \{R_9, R_9\}$ ; 4;  $-\Gamma_{3,0}, -i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;  
 $\{R_7, R_7\}, \{R_8, R_8\}$ ; 4;  $-\Gamma_{3,0}, i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNLs;  
 $\{R_7, R_7\}, \{R_9, R_9\}$ ; 4;  $-\Gamma_{3,0}, i\Gamma_{0,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $\{R_8, R_8\}, \{R_9, R_9\}$ ; 4;  $\Gamma_{0,0}, -i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; P-DNL;  
 $Z'$ ;  $X'M(\frac{1}{2}\alpha 0)$ ;  $\sigma_x, C_{2y}, IT$ ;  $\{R_5, R_6\}, \{R_7, R_8\}$ ; 4;  $i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}$ ; P-DNL;

SG 206

Accidental degeneracies on high symmetry line

$\Lambda$ ;  $\Gamma P$ ;  $C_{31}^-, IT$ ;  $\{R_2, R_6\}, \{R_4, R_4\}$ ; 4;  $\Gamma_{12}, -i\Gamma_{0,2}$ ; DP; 0  
 $D$ ; NP;  $C_{2z}, \bar{E}, IT$ ;  $\{R_5, R_5\}, \{R_7, R_7\}$ ; 4;  $-i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0  
 $F$ ; PH;  $C_{34}^+, \bar{E}, IT$ ;  $\{R_7, R_7\}, \{R_9, R_{11}\}$ ; 4;  $\Gamma_{17}, -\Gamma_{0,0}, -i\Gamma_{0,2}$ ; DP; 0

SG 207

Accidental degeneracies on high symmetry line

$\Delta$ ;  $\Gamma X$ ;  $C_{4y}^+, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1  
 $\{R_2\}, \{R_6\}$ ; 2;  $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2  
 $\{R_2\}, \{R_8\}$ ; 2;  $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1  
 $\{R_4\}, \{R_6\}$ ; 2;  $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1  
 $\{R_4\}, \{R_8\}$ ; 2;  $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2  
 $\{R_6\}, \{R_8\}$ ; 2;  $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1  
 $\Sigma$ ;  $\Gamma M$ ;  $C_{2a}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $\Lambda$ ;  $\Gamma R$ ;  $C_{31}^-, C_{2e}\mathcal{T}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $\sigma_9, \sigma_0$ ; C-1 WP; 1  
 $\{R_2\}, \{R_6\}$ ; 2;  $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1  
 $\{R_4\}, \{R_6\}$ ; 2;  $\sigma_{10}, \sigma_0$ ; C-1 WP; 1  
 $S$ ; XR;  $C_{2c}, \mathcal{T}C_{2y}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $Z$ ; XM;  $C_{2x}, \mathcal{T}C_{2z}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $i\sigma_3, \sigma_0$ ; C-1 WP; 1  
 $T$ ; MR;  $C_{4z}^+, C_{2a}\mathcal{T}$ ;  $\{R_2\}, \{R_4\}$ ; 2;  $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1  
 $\{R_2\}, \{R_6\}$ ; 2;  $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2  
 $\{R_2\}, \{R_8\}$ ; 2;  $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1  
 $\{R_4\}, \{R_6\}$ ; 2;  $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1  
 $\{R_4\}, \{R_8\}$ ; 2;  $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2  
 $\{R_6\}, \{R_8\}$ ; 2;  $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1

SG 208

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
	$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
	$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma R$ ; $C_{31}^-, C_{2e}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ;	C-1 WP; 1
	$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$S$ ; $XR$ ; $C_{2c}, \bar{E}, \mathcal{T}C_{2y}$ ;	$\{R_5\}, \{R_7\}$ ; 2; $-i\sigma_3, -\sigma_0, \sigma_0$ ;	C-1 WP; 1
$Z$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$T$ ; $MR$ ; $C_{4z}^+, \bar{E}, C_{2a}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, -\sigma_0, \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_6\}$ ; 2; $-\sqrt[4]{-1}\sigma_3, -\sigma_0, \sigma_0$ ;	C-2 WP; 2
	$\{R_2\}, \{R_8\}$ ; 2; $-\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, -\sigma_0, \sigma_0$ ;	C-1 WP; 1
	$\{R_4\}, \{R_6\}$ ; 2; $\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, -\sigma_0, \sigma_0$ ;	C-1 WP; 1
	$\{R_4\}, \{R_8\}$ ; 2; $-(-1)^{3/4}\sigma_3, -\sigma_0, \sigma_0$ ;	C-2 WP; 2
	$\{R_6\}, \{R_8\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, -\sigma_0, \sigma_0$ ;	C-1 WP; 1

SG 209

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
	$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
	$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ;	C-2 WP; 2
	$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ;	C-1 WP; 1
$\Lambda$ ; $\Gamma L$ ; $C_{31}^-, C_{2e}\mathcal{T}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ;	C-1 WP; 1
	$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ;	C-1 WP; 1
	$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ;	C-1 WP; 1
$\Sigma$ ; $\Gamma \Sigma$ ; $C_{2a}, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$S$ ; $XS$ ; $C_{2c}, \mathcal{T}C_{2y}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Z$ ; $XW$ ; $C_{2x}, \mathcal{T}C_{2z}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ;	C-1 WP; 1
$Q$ ; $LW$ ; $C_{2f}$ ;	$\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3$ ;	C-1 WP; 1

## Accidental degeneracies on high symmetry line

$\Delta; \Gamma X;$	$C_{4y}^+, \mathcal{T}C_{2z};$	$\{R_2\}, \{R_4\};$	$2; \frac{\sigma_3 + i\sigma_0}{\sqrt{2}}, \sigma_0;$	C-1 WP; 1
		$\{R_2\}, \{R_6\};$	$2; \sqrt[4]{-1}\sigma_3, \sigma_0;$	C-2 WP; 2
		$\{R_2\}, \{R_8\};$	$2; \frac{\sigma_0 + i\sigma_3}{\sqrt{2}}, \sigma_0;$	C-1 WP; 1
		$\{R_4\}, \{R_6\};$	$2; -\frac{\sigma_0 - i\sigma_3}{\sqrt{2}}, \sigma_0;$	C-1 WP; 1
		$\{R_4\}, \{R_8\};$	$2; (-1)^{3/4}\sigma_3, \sigma_0;$	C-2 WP; 2
		$\{R_6\}, \{R_8\};$	$2; \frac{-\sigma_3 - i\sigma_0}{\sqrt{2}}, \sigma_0;$	C-1 WP; 1
$\Lambda; \Gamma L;$	$C_{31}^-, C_{2e}\mathcal{T};$	$\{R_2\}, \{R_4\};$	$2; \sigma_9, \sigma_0;$	C-1 WP; 1
		$\{R_2\}, \{R_6\};$	$2; \frac{\sigma_0 + i\sqrt{3}\sigma_3}{2}, \sigma_0;$	C-1 WP; 1
		$\{R_4\}, \{R_6\};$	$2; \sigma_{10}, \sigma_0;$	C-1 WP; 1
$\Sigma; \Gamma \Sigma;$	$C_{2a}, \mathcal{T}C_{2z};$	$\{R_2\}, \{R_4\};$	$2; i\sigma_3, \sigma_0;$	C-1 WP; 1
$S; XS;$	$C_{2c}, \bar{E}, \mathcal{T}C_{2y};$	$\{R_5\}, \{R_7\};$	$2; -i\sigma_3, -\sigma_0, \sigma_0;$	C-1 WP; 1
$Z; XW;$	$C_{2x}, \mathcal{T}C_{2z};$	$\{R_2\}, \{R_4\};$	$2; i\sigma_3, \sigma_0;$	C-1 WP; 1
$Q; LW;$	$C_{2f}, \bar{E};$	$\{R_{10}\}, \{R_{14}\};$	$2; -i\sigma_3, -\sigma_0;$	C-1 WP; 1

## SG 211

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma N$ ; $C_{2a}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Delta$ ; $\Gamma H$ ; $C_{4y}^+, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma P$ ; $C_{31}^-, C_{2e}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1
$D$ ; $NP$ ; $C_{2z}, C_{2a}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$G$ ; $HN$ ; $C_{2b}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$F$ ; $PH$ ; $C_{34}^+, C_{2a}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1

## SG 212

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma R$ ; $C_{31}^-, C_{2e}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1
$T$ ; $MR$ ; $C_{4z}^+, \bar{E}, C_{2a}\mathcal{T}$ ; $\{R_{10}, R_{14}\}, \{R_{12}, R_{16}\}$ ; 4; $\frac{-\Gamma_{3,3}-i\Gamma_{0,3}}{\sqrt{2}}, -\Gamma_{0,0}, \Gamma_{0,1}$ ; C-2 DP; 2

## SG 213

Accidental degeneracies on high symmetry line

$\Delta$ ; $\Gamma X$ ; $C_{4y}^+, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\Sigma$ ; $\Gamma M$ ; $C_{2a}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma R$ ; $C_{31}^-, C_{2e}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1
$T$ ; $MR$ ; $C_{4z}^+, \bar{E}, C_{2a}\mathcal{T}$ ; $\{R_{10}, R_{14}\}, \{R_{12}, R_{16}\}$ ; 4; $\frac{-\Gamma_{3,3}-i\Gamma_{0,3}}{\sqrt{2}}, -\Gamma_{0,0}, \Gamma_{0,1}$ ; C-2 DP; 2

## SG 214

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma N$ ; $C_{2a}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1
$\Delta$ ; $\Gamma H$ ; $C_{4y}^+, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\frac{\sigma_3+i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\sqrt[4]{-1}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_2\}, \{R_8\}$ ; 2; $\frac{\sigma_0+i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $-\frac{\sigma_0-i\sigma_3}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_8\}$ ; 2; $(-1)^{3/4}\sigma_3, \sigma_0$ ; C-2 WP; 2
$\{R_6\}, \{R_8\}$ ; 2; $\frac{-\sigma_3-i\sigma_0}{\sqrt{2}}, \sigma_0$ ; C-1 WP; 1
$\Lambda$ ; $\Gamma P$ ; $C_{31}^-, C_{2e}\mathcal{T}$ ; $\{R_2\}, \{R_4\}$ ; 2; $\sigma_9, \sigma_0$ ; C-1 WP; 1
$\{R_2\}, \{R_6\}$ ; 2; $\frac{\sigma_0+i\sqrt{3}\sigma_3}{2}, \sigma_0$ ; C-1 WP; 1
$\{R_4\}, \{R_6\}$ ; 2; $\sigma_{10}, \sigma_0$ ; C-1 WP; 1
$D$ ; $NP$ ; $C_{2z}, \bar{E}, C_{2a}\mathcal{T}$ ; $\{R_5\}, \{R_7\}$ ; 2; $-i\sigma_3, -\sigma_0, \sigma_0$ ; C-1 WP; 1
$G$ ; $HN$ ; $C_{2b}, \bar{E}, \mathcal{T}C_{2z}$ ; $\{R_5\}, \{R_7\}$ ; 2; $-i\sigma_3, -\sigma_0, \sigma_0$ ; C-1 WP; 1
$F$ ; $PH$ ; $C_{34}^+, \bar{E}, C_{2a}\mathcal{T}$ ; $\{R_7\}, \{R_{11}\}$ ; 2; $\sigma_{20}, -\sigma_0, \sigma_0$ ; C-1 WP; 1
$\{R_7\}, \{R_9\}$ ; 2; $\sigma_{19}, -\sigma_0, \sigma_0$ ; C-1 WP; 1
$\{R_9\}, \{R_{11}\}$ ; 2; $\frac{\sqrt{3}\sigma_3+i\sigma_0}{2}, -\sigma_0, \sigma_0$ ; C-1 WP; 1

## SG 215

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma M$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma R$ ; $C_{31}^-, \sigma_{db}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;
$S$ ; $XR$ ; $\sigma_{de}, \mathcal{T}\sigma_{dc}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$Z$ ; $XM$ ; $C_{2x}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 216

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\text{L}$ ; $C_{31}^-, \sigma_{db}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;
$\Sigma$ ; $\Gamma\Sigma$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$S$ ; $\text{XS}$ ; $\sigma_{de}, \mathcal{T}\sigma_{dc}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$Z$ ; $\text{XW}$ ; $C_{2x}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 217

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma\text{N}$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma\text{P}$ ; $C_{31}^-, \sigma_{db}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;
$G$ ; $\text{HN}$ ; $\sigma_{da}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$F$ ; $\text{PH}$ ; $C_{34}^+, \sigma_{da}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;

## SG 218

Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma\text{M}$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma\text{R}$ ; $C_{31}^-, \sigma_{db}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;
$Z$ ; $\text{XM}$ ; $C_{2x}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## SG 219

Accidental degeneracies on high symmetry line

$\Lambda$ ; $\Gamma\text{L}$ ; $C_{31}^-, \sigma_{db}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;
$\Sigma$ ; $\Gamma\Sigma$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$S$ ; $\text{XS}$ ; $\sigma_{de}, \mathcal{T}\sigma_{dc}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$Z$ ; $\text{XW}$ ; $C_{2x}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; C-1 WP; 1

## Accidental degeneracies on high symmetry line

$\Sigma$ ; $\Gamma\text{N}$ ; $\sigma_{db}, \mathcal{T}C_{2z}$ ; $\{R_2\}, \{R_4\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\Lambda$ ; $\Gamma\text{P}$ ; $C_{31}^-, \sigma_{db}$ ; $\{R_3\}, \{R_4\}$ ; 2; $-\sigma_0, i\sigma_3$ ; P-WNLs;
$\{R_3\}, \{R_6\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}$ ; TP;
$\{R_4\}, \{R_6\}$ ; 3; $A_{24}, iA_{10}$ ; TP;
$D$ ; $\text{NP}$ ; $C_{2z}, \sigma_{db}$ ; $\{R_5\}, \{R_6\}$ ; 2; $i\sigma_0, \sigma_3$ ; P-WNLs;
$\{R_5\}, \{R_7\}$ ; 2; $i\sigma_3, \sigma_3$ ; P-WNL;
$\{R_5\}, \{R_8\}$ ; 2; $i\sigma_3, \sigma_0$ ; P-WNL;
$\{R_6\}, \{R_7\}$ ; 2; $i\sigma_3, -\sigma_0$ ; P-WNL;
$\{R_6\}, \{R_8\}$ ; 2; $i\sigma_3, -\sigma_3$ ; P-WNL;
$\{R_7\}, \{R_8\}$ ; 2; $-i\sigma_0, -\sigma_3$ ; P-WNLs;
$F$ ; $\text{PH}$ ; $C_{34}^+, \sigma_{da}, E$ ; $\{R_9\}, \{R_{10}\}$ ; 2; $-\sigma_0, i\sigma_3, \sigma_0$ ; P-WNLs;
$\{R_9\}, \{R_{12}\}$ ; 3; $A_{24}, \frac{i(A_0+2\sqrt{3}A_8)}{3}, A_0$ ; TP;
$\{R_{10}\}, \{R_{12}\}$ ; 3; $A_{24}, iA_{10}, A_0$ ; TP;



## SG 221

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma X; C_{4y}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
\Lambda; \Gamma R; C_{31}^-, \sigma_{db}, IT; \{R_3, R_4\}, \{R_6\}; & \quad 4; \Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
T; \text{MR}; C_{4z}^+, \sigma_y, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0
\end{aligned}$$

## SG 222

---

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma X; C_{4y}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
\Lambda; \Gamma R; C_{31}^-, \sigma_{db}, IT; \{R_3, R_4\}, \{R_6\}; & \quad 4; \Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
S; \text{XR}; \sigma_y, C_{2c}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0 \\
Z; \text{XM}; \sigma_y, C_{2x}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0 \\
T; \text{MR}; C_{4z}^-, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, -\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0
\end{aligned}$$

## SG 223

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma X; C_{4y}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
\Lambda; \Gamma R; C_{31}^-, \sigma_{db}, IT; \{R_3, R_4\}, \{R_6\}; & \quad 4; \Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
S; \text{XR}; C_{2c}, \sigma_y, IT; \{R_5, R_6\}, \{R_7, R_8\}; & \quad 4; i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
T; \text{MR}; C_{4z}^+, \sigma_x, E, IT; \{R_{13}\}, \{R_{14}\}; & \quad 4; \frac{-\Gamma_{3,0} - i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, \Gamma_{0,0}, -i\Gamma_{0,2}; \text{DP}; 0
\end{aligned}$$

## SG 224

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma X; C_{4y}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
\Lambda; \Gamma R; C_{31}^-, \sigma_{db}, IT; \{R_3, R_4\}, \{R_6\}; & \quad 4; \Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
Z; \text{XM}; \sigma_y, C_{2x}, IT; \{R_5, R_8\}, \{R_6, R_7\}; & \quad 4; i\Gamma_{0,3}, i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0 \\
T; \text{MR}; C_{4z}^-, \sigma_y, IT; \{R_6\}, \{R_7\}; & \quad 4; -\frac{\Gamma_{0,1} + i\Gamma_{3,0}}{\sqrt{2}}, -\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0
\end{aligned}$$

## SG 225

---

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma X; C_{4y}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
\Lambda; \Gamma L; C_{31}^-, \sigma_{db}, IT; \{R_3, R_4\}, \{R_6\}; & \quad 4; \Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0
\end{aligned}$$

## SG 226

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma X; C_{4y}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
\Lambda; \Gamma L; C_{31}^-, \sigma_{db}, IT; \{R_3, R_4\}, \{R_6\}; & \quad 4; \Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
Q; LW; C_{2f}, IT; \{R_2, R_2\}, \{R_4, R_4\}; & \quad 4; i\Gamma_{3,0}, -i\Gamma_{0,2}; \text{DP}; 0
\end{aligned}$$

## SG 227

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma X; C_{4y}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
\Lambda; \Gamma L; C_{31}^-, \sigma_{db}, IT; \{R_3, R_4\}, \{R_6\}; & \quad 4; \Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
Z; XW; \sigma_y, \sigma_z, IT; \{R_5, R_7\}, \{R_6, R_8\}; & \quad 4; i\Gamma_{0,3}, \Gamma_{3,3}, -i\Gamma_{0,2}; \text{DP}; 0
\end{aligned}$$

## SG 228

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma X; C_{4y}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
\Lambda; \Gamma L; C_{31}^-, \sigma_{db}, IT; \{R_3, R_4\}, \{R_6\}; & \quad 4; \Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
Z; XW; \sigma_y, \sigma_z, IT; \{R_5, R_7\}, \{R_6, R_8\}; & \quad 4; i\Gamma_{0,3}, \Gamma_{3,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
Q; LW; C_{2f}, \bar{E}, IT; \{R_{10}, R_{10}\}, \{R_{14}, R_{14}\}; & \quad 4; -i\Gamma_{3,0}, -\Gamma_{0,0}, -i\Gamma_{0,2}; \text{DP}; 0
\end{aligned}$$

## SG 229

---

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma H; C_{4y}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
\Lambda; \Gamma P; C_{31}^-, \sigma_{db}, IT; \{R_3, R_4\}, \{R_6\}; & \quad 4; \Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
F; PH; C_{34}^+, \sigma_{da}, IT; \{R_3, R_4\}, \{R_6\}; & \quad 4; \Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0
\end{aligned}$$

## SG 230

---

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \Gamma H; C_{4y}^+, \sigma_x, IT; \{R_6\}, \{R_7\}; & \quad 4; \frac{\Gamma_{3,0} + i\Gamma_{0,2}}{\sqrt{2}}, i\Gamma_{0,1}, -i\Gamma_{0,2}; \text{DP}; 0 \\
\Lambda; \Gamma P; C_{31}^-, \sigma_{db}, IT; \{R_3, R_4\}, \{R_6\}; & \quad 4; \Gamma_{13}, i\Gamma_{0,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
D; NP; C_{2z}, \sigma_{db}, IT; \{R_5, R_6\}, \{R_7, R_8\}; & \quad 4; i\Gamma_{3,0}, \Gamma_{3,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
G; HN; C_{2b}, \sigma_{da}, IT; \{R_5, R_6\}, \{R_7, R_8\}; & \quad 4; i\Gamma_{3,0}, i\Gamma_{3,3}, -i\Gamma_{0,2}; \text{DP}; 0 \\
F; PH; C_{34}^+, \sigma_{da}, E, IT; \{R_9, R_{10}\}, \{R_{12}\}; & \quad 4; i\Gamma_{13}, i\Gamma_{0,3}, \Gamma_{0,0}, -i\Gamma_{0,2}; \text{DP}; 0
\end{aligned}$$

### C. Effective Hamiltonian of both essential and accidental degeneracies

#### 1. Notes to Sec. S8C

- (i) The top and bottom part of the tables in Sec. S8C lists the essential and accidental degeneracy, respectively.
- (ii) For each table in Sec. S8C, the first two lines present the SG number, the BZ type, the generating elements of the type II MSG (translations are not included here), whether centrosymmetry is contained in the group, and whether SOC is considered.
- (iii) Below the first two lines, the columns from left to right (separated by the semicolons) are the high-symmetry momentum  $\mathbf{k}$ , the corep and the effective Hamiltonian of the symmetry-protected degeneracies.
- (iv) In effective Hamiltonian, we use Roman letters (such as  $c_i$  and  $c_{i,j}$ ) and Greek letter (such as  $\alpha_i$ ) to denote the real and complex parameters, respectively.
- (v) We do not list the type II MSGs that do not exhibit symmetry-protected degeneracies at high-symmetry point and high-symmetry line.

#### 2. SG 1-10

## SG 1

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 $\Gamma_t; \{\bar{E}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}\Gamma; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z) + c_1\sigma_0; \\ B; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z) + c_1\sigma_0; \\ F; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z) + c_1\sigma_0; \\ G; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z) + c_1\sigma_0;\end{aligned}$$

## SG 3

---

 $\Gamma_m; \{C_{2z}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}\Gamma; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ B; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ Y; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ Z; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ C; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ D; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ A; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ E; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0;\end{aligned}$$

---

Accidental degeneracies on high symmetry line

$$\begin{aligned}\Lambda; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\ V; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\ W; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\ U; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y);\end{aligned}$$

## SG 4

---

 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}\Gamma; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ B; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ Y; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ Z; \{R_5, R_5\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\ \{R_7, R_7\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\ C; \{R_5, R_5\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\ \{R_7, R_7\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\ D; \{R_5, R_5\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\ \{R_7, R_7\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\ A; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ E; \{R_5, R_5\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\ \{R_7, R_7\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0;\end{aligned}$$

---

Accidental degeneracies on high symmetry line

$$\begin{aligned}\Lambda; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y); \\ V; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y); \\ W; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y); \\ U; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);\end{aligned}$$

---

SG 5

$\Gamma_m^b; \{C_{2z}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}\Gamma; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ A; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ Z; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ M; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\ L; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i(c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z) + c_1\sigma_0; \\ V; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i(c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z) + c_1\sigma_0;\end{aligned}$$

---

Accidental degeneracies on high symmetry line

$$\begin{aligned}\Lambda; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y); \\ U; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);\end{aligned}$$

---

SG 6

$\Gamma_m; \{\sigma_z|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}\Gamma; \{R_2, R_4\}; \sigma_3(c_2k_x + c_3k_y) + (c_4\sigma_1 - c_5\sigma_2)k_z + c_1\sigma_0; \\ B; \{R_2, R_4\}; \sigma_3(c_2k_x + c_3k_y) + (c_4\sigma_1 - c_5\sigma_2)k_z + c_1\sigma_0; \\ Y; \{R_2, R_4\}; \sigma_3(c_2k_x + c_3k_y) + (c_4\sigma_1 - c_5\sigma_2)k_z + c_1\sigma_0; \\ Z; \{R_2, R_4\}; \sigma_3(c_2k_x + c_3k_y) + (c_4\sigma_1 - c_5\sigma_2)k_z + c_1\sigma_0; \\ C; \{R_2, R_4\}; \sigma_3(c_2k_x + c_3k_y) + (c_4\sigma_1 - c_5\sigma_2)k_z + c_1\sigma_0; \\ D; \{R_2, R_4\}; \sigma_3(c_2k_x + c_3k_y) + (c_4\sigma_1 - c_5\sigma_2)k_z + c_1\sigma_0; \\ A; \{R_2, R_4\}; \sigma_3(c_2k_x + c_3k_y) + (c_4\sigma_1 - c_5\sigma_2)k_z + c_1\sigma_0; \\ E; \{R_2, R_4\}; \sigma_3(c_2k_x + c_3k_y) + (c_4\sigma_1 - c_5\sigma_2)k_z + c_1\sigma_0;\end{aligned}$$

## SG 7

---

 $\Gamma_m; \{\sigma_z | \frac{1}{2}00\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
&\Gamma; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0; \\
&B; \{R_5, R_5\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&\quad \{R_7, R_7\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&Y; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0; \\
&Z; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0; \\
&C; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0; \\
&D; \{R_5, R_5\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&\quad \{R_7, R_7\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&A; \{R_5, R_5\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&\quad \{R_7, R_7\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&E; \{R_5, R_5\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&\quad \{R_7, R_7\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&V; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + \sigma_0 (c_2 k_z + c_1); \\
&U; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + \sigma_0 (c_2 k_z + c_1);
\end{aligned}$$

## SG 8

---

 $\Gamma_m^b; \{\sigma_z | 000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
&\Gamma; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0; \\
&A; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0; \\
&Z; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0; \\
&M; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0; \\
&L; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z) + c_1 \sigma_0; \\
&V; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z) + c_1 \sigma_0;
\end{aligned}$$

## SG 9

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 $\Gamma_m^b; \{\sigma_z | \frac{1}{2}00\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
&\Gamma; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0; \\
&A; \{R_1, R_1\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&\quad \{R_3, R_3\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&Z; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0; \\
&M; \{R_1, R_1\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&\quad \{R_3, R_3\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_1 \sigma_0; \\
&L; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z) + c_1 \sigma_0; \\
&V; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z) + c_1 \sigma_0; \\
&U; \{R_2, R_2\}; \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + \sigma_0 (c_2 k_z + c_1);
\end{aligned}$$

## SG 11

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 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} Z; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \Gamma_{0,2}(c_2k_x + c_3k_y) + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_z; \\ C; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \Gamma_{0,2}(c_2k_x + c_3k_y) + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_z; \\ D; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \Gamma_{0,2}(c_2k_x + c_3k_y) + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_z; \\ E; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \Gamma_{0,2}(c_2k_x + c_3k_y) + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_z; \end{aligned}$$

## SG 13

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 $\Gamma_m; \{C_{2z}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} B; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y); \\ D; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y); \\ A; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y); \\ E; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} V; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + \Gamma_{1,0}(c_4k_x + c_5k_y) + \sum_{i=1}^3 \Gamma_{2,i}(c_{i,1}k_x + c_{i,2}k_y); \\ U; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + \Gamma_{1,0}(c_4k_x + c_5k_y) + \sum_{i=1}^3 \Gamma_{2,i}(c_{i,1}k_x + c_{i,2}k_y); \end{aligned}$$

## SG 14

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 $\Gamma_m; \{C_{2z}|00\frac{1}{2}\}, \{I|\frac{1}{2}0\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} B; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y); \\ Z; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \Gamma_{0,2}(c_2k_x + c_3k_y) + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_z; \\ C; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \Gamma_{0,2}(c_2k_x + c_3k_y) + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_z; \\ A; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} V; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + \Gamma_{1,0}(c_4k_x + c_5k_y) + \sum_{i=1}^3 \Gamma_{2,i}(c_{i,1}k_x + c_{i,2}k_y); \\ U; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + \Gamma_{1,0}(c_4k_x + c_5k_y) + \sum_{i=1}^3 \Gamma_{2,i}(c_{i,1}k_x + c_{i,2}k_y); \end{aligned}$$

## SG 15

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 $\Gamma_m^b; \{C_{2z}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} A; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y); \\ M; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$U; \{R_2, R_2\}, \{R_4, R_4\}; \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \sum_{i=1}^3 \Gamma_{2,i}(c_{i,1} k_x + c_{i,2} k_y);$$

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SG 16

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

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$$\Gamma; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0;$$

$$Y; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0;$$

$$X; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0;$$

$$Z; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0;$$

$$U; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0;$$

$$T; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0;$$

$$S; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0;$$

$$R; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0;$$

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Accidental degeneracies on high symmetry line

$$\Delta; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z;$$

$$D; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z;$$

$$P; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z;$$

$$B; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z;$$

$$\Sigma; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z;$$

$$C; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z;$$

$$E; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z;$$

$$A; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z;$$

$$\Lambda; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x;$$

$$H; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x;$$

$$Q; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x;$$

$$G; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x;$$



$$\begin{aligned}
\Gamma; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
Y; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
X; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
Z; \{R_5, R_6\}; & \quad (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
& \quad \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
U; \{R_5, R_6\}; & \quad (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
& \quad \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
T; \{R_5, R_6\}; & \quad (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
& \quad \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
S; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
R; \{R_5, R_6\}; & \quad (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
& \quad \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
P; \{R_2, R_4\}; & \quad \sigma_0(c_2k_y + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_z; \\
B; \{R_2, R_4\}; & \quad \sigma_0(c_2k_y + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_z; \\
E; \{R_5, R_7\}; & \quad \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_z; \\
A; \{R_5, R_7\}; & \quad \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
D; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
\Sigma; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
C; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
\Lambda; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
H; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
Q; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
G; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x;
\end{aligned}$$

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
Y; \{R_5, R_6\}; & (c_2\sigma_1 - c_3\sigma_2)k_y + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_y + c_1\sigma_0; \\
X; \{R_5, R_6\}; & (c_2\sigma_1 - c_3\sigma_2)k_x + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_x + c_1\sigma_0; \\
Z; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
U; \{R_5, R_6\}; & (c_2\sigma_1 - c_3\sigma_2)k_x + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_x + c_1\sigma_0; \\
T; \{R_5, R_6\}; & (c_2\sigma_1 - c_3\sigma_2)k_y + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_y + c_1\sigma_0; \\
S; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_z + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,2}k_y); \\
R; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_z + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,2}k_y); \\
D; \{R_5, R_7\}; & \sigma_0(c_2k_y + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_x; \\
P; \{R_5, R_7\}; & \sigma_0(c_2k_y + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_x; \\
C; \{R_5, R_7\}; & \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_y; \\
E; \{R_5, R_7\}; & \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_y; \\
H; \{R_2, R_4\}; & \sigma_0(c_2k_z + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_y; \\
Q; \{R_2, R_2\}; & \sum_{i=1}^3 c_{i,1}\sigma_i k_x k_y + \sigma_0(c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_5k_z + c_1); \\
& \{R_4, R_4\}; \sum_{i=1}^3 c_{i,1}\sigma_i k_x k_y + \sigma_0(c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_5k_z + c_1); \\
G; \{R_2, R_4\}; & \sigma_0(c_2k_z + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
B; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
\Sigma; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
A; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
\Lambda; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
Q; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4\Gamma_{2,0}k_x + c_5\Gamma_{1,0}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{1,i}k_x + c_{i,2}\Gamma_{2,i}k_y);
\end{aligned}$$

$\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
&\Gamma; R_5; \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
&Y; \{R_5, R_6\}; (c_2\sigma_1 - c_3\sigma_2)k_y + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_y + c_1\sigma_0; \\
&X; \{R_5, R_6\}; (c_2\sigma_1 - c_3\sigma_2)k_x + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_x + c_1\sigma_0; \\
&Z; \{R_5, R_6\}; (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
&U; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_z); \\
&T; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_x + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_z + c_{i,2}\Gamma_{i,1}k_y); \\
&S; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_z + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_y + c_{i,2}\Gamma_{i,1}k_x); \\
&R; \{R_6, R_6\}; \sigma_0 (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_x k_y k_z; \\
&\quad \{R_7, R_7\}; \sigma_0 (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_x k_y k_z; \\
&\quad \{R_8, R_8\}; \sigma_0 (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_x k_y k_z; \\
&\quad \{R_9, R_9\}; \sigma_0 (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_x k_y k_z; \\
&D; \{R_5, R_7\}; \sigma_0 (c_2k_y + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_x; \\
&P; \{R_5, R_5\}; \sigma_0 (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_5k_y + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_x k_z; \\
&\quad \{R_7, R_7\}; \sigma_0 (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_5k_y + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_x k_z; \\
&B; \{R_2, R_4\}; \sigma_0 (c_2k_y + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_z; \\
&C; \{R_2, R_4\}; \sigma_0 (c_2k_x + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_y; \\
&E; \{R_5, R_5\}; \sigma_0 (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_5k_x + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_y k_z; \\
&\quad \{R_7, R_7\}; \sigma_0 (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_5k_x + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_y k_z; \\
&A; \{R_5, R_7\}; \sigma_0 (c_2k_x + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_z; \\
&H; \{R_5, R_7\}; (c_2\sigma_1 - c_4\sigma_2)k_y + \sigma_0 (c_3k_z + c_1); \\
&Q; \{R_5, R_5\}; \sigma_0 (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_5k_z + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_x k_y; \\
&\quad \{R_7, R_7\}; \sigma_0 (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_5k_z + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_x k_y; \\
&G; \{R_2, R_4\}; (c_2\sigma_1 - c_4\sigma_2)k_x + \sigma_0 (c_3k_z + c_1);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
&P; \{R_5, R_5\}, \{R_7, R_7\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + c_4\Gamma_{2,0}k_x + c_5\Gamma_{1,0}k_z + \sum_{i=1}^3 (c_{i,1}\Gamma_{1,i}k_x + c_{i,2}\Gamma_{2,i}k_z); \\
&\Sigma; \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
&E; \{R_5, R_5\}, \{R_7, R_7\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + c_4\Gamma_{2,0}k_z + c_5\Gamma_{1,0}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{1,i}k_z + c_{i,2}\Gamma_{2,i}k_y); \\
&\Lambda; \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
&Q; \{R_5, R_5\}, \{R_7, R_7\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4\Gamma_{2,0}k_x + c_5\Gamma_{1,0}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{1,i}k_x + c_{i,2}\Gamma_{2,i}k_y);
\end{aligned}$$

SG 20

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 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
Y; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
Z; \{R_5, R_6\}; & (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
T; \{R_5, R_6\}; & (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
S; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\
R; \{R_5, R_5\}; & (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_7, R_7\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
A; \{R_2, R_4\}; & \sigma_0 (c_2k_x + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_z; \\
B; \{R_5, R_7\}; & \sigma_0 (c_2k_y + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_z; \\
G; \{R_5, R_7\}; & \sigma_0 (c_2k_y + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_z; \\
E; \{R_2, R_4\}; & \sigma_0 (c_2k_x + c_1) + (c_3\sigma_1 - c_4\sigma_2)k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
H; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
D; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
C; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;
\end{aligned}$$

## 4. SG 21-30

## SG 21

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 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}'|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
 \Gamma; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
 Y; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
 Z; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
 T; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
 S; \{R_2, R_4\}; & \quad \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\
 R; \{R_2, R_4\}; & \quad \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0;
 \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Lambda; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
 H; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\
 D; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\
 A; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
 \Sigma; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
 \Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
 B; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
 G; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
 F; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\
 E; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
 C; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z;
 \end{aligned}$$

## SG 22

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 $\Gamma_o^f; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
 \Gamma; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
 Y; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
 X; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
 Z; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\
 L; \{R_2, R_2\}; & \quad \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z) + c_1\sigma_0;
 \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
G; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
H; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
Q; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
C; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
A; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z; \\
D; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z; \\
B; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z; \\
R; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z;
\end{aligned}$$

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SG 23

$\Gamma_o^v; \{C_{2z}|000\}, \{C_{2y}|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_5; & c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
X; R_5; & c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
R; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z) + c_2 \sigma_3 k_y + c_1 \sigma_0; \\
S; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z) + c_2 \sigma_3 k_x + c_1 \sigma_0; \\
T; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_2 \sigma_3 k_z + c_1 \sigma_0; \\
W; R_5; & c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
G; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_y + c_5 \sigma_2 k_x; \\
P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
D; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x + c_5 \sigma_1 k_z; \\
Q; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z);
\end{aligned}$$

## SG 24

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 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned} \Gamma; R_5; & c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\ X; R_5; & c_2\sigma_3k_x + c_3\sigma_1k_y - c_4\sigma_2k_z + c_1\sigma_0; \\ R; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_z) + c_2\sigma_3k_y + c_1\sigma_0; \\ S; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1}k_y + c_{i,2}k_z) + c_2\sigma_3k_x + c_1\sigma_0; \\ T; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\ G; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_y + c_5\sigma_2k_x; \\ P; \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\ \Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\ F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\ D; \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + \sum_{i=1}^2 \sigma_i (c_{i,1}k_y + c_{i,2}k_z); \\ \Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\ U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x + c_5\sigma_1k_z; \\ Q; \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_z); \end{aligned}$$

## SG 25

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 $\Gamma_o; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned} \Gamma; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\ Y; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\ X; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\ Z; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\ U; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\ T; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\ S; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\ R; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\ \Lambda; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0 (c_4k_z + c_1); \\ H; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0 (c_4k_z + c_1); \\ Q; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0 (c_4k_z + c_1); \\ G; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0 (c_4k_z + c_1); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
D; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
P; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
B; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
C; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
E; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
A; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y;
\end{aligned}$$

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SG 26

$\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

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$$\begin{aligned}
\Gamma; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Y; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
X; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Z; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,0}k_z); \\
U; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,0}k_z); \\
T; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,0}k_z); \\
S; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
R; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,0}k_z); \\
P; \{R_2, R_2\}; & \sigma_0(c_2k_y + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
& \{R_4, R_4\}; \sigma_0(c_2k_y + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
B; \{R_2, R_2\}; & \sigma_0(c_2k_y + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
& \{R_4, R_4\}; \sigma_0(c_2k_y + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
E; \{R_2, R_4\}; & \sigma_0(c_2k_x + c_1) + c_3\sigma_3k_z; \\
A; \{R_2, R_4\}; & \sigma_0(c_2k_x + c_1) + c_3\sigma_3k_z; \\
\Lambda; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
H; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
Q; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
G; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
D; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
P; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + c_4\Gamma_{1,0}k_x + \sum_{i=1}^3 [k_z(c_{i,1}\Gamma_{0,i} + c_{i,2}\Gamma_{3,i}) + c_{i,3}k_x\Gamma_{2,i}]; \\
B; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + c_4\Gamma_{1,0}k_x + \sum_{i=1}^3 [k_z(c_{i,1}\Gamma_{0,i} + c_{i,2}\Gamma_{3,i}) + c_{i,3}k_x\Gamma_{2,i}]; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
C; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y;
\end{aligned}$$



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 $\Gamma_o; \{C_{2z}|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Y; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
X; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Z; \{R_9, R_9\}; & \quad c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_y + c_{i,3}\Gamma_{i,0}k_z); \\
U; \{R_9, R_9\}; & \quad c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_y + c_{i,3}\Gamma_{i,0}k_z); \\
T; \{R_9, R_9\}; & \quad c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_y + c_{i,3}\Gamma_{i,0}k_z); \\
S; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
R; \{R_9, R_9\}; & \quad c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_y + c_{i,3}\Gamma_{i,0}k_z); \\
P; \{R_2, R_4\}; & \quad \sigma_0(c_3k_y + c_1) + (c_2\sigma_1 - c_5\sigma_2)k_x + c_4\sigma_3k_z; \\
B; \{R_2, R_4\}; & \quad \sigma_0(c_3k_y + c_1) + (c_2\sigma_1 - c_5\sigma_2)k_x + c_4\sigma_3k_z; \\
E; \{R_2, R_4\}; & \quad \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
A; \{R_2, R_4\}; & \quad \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
\Lambda; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
H; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
Q; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
G; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
D; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
\Sigma; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
C; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y;
\end{aligned}$$

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 $\Gamma_o; \{C_{2z}|\frac{1}{2}00\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Y; \{R_5, R_6\}; & (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
X; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Z; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
U; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
T; \{R_5, R_6\}; & (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
S; \{R_5, R_6\}; & (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
R; \{R_5, R_6\}; & (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
C; \{R_2, R_4\}; & \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
E; \{R_2, R_4\}; & \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
\Lambda; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
G; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
D; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
P; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
B; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
A; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
H; \{R_5\}, \{R_6\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
& \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
Q; \{R_5\}, \{R_6\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
& \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z;
\end{aligned}$$

$\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
&\Gamma; R_5; \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
&Y; \{R_5, R_6\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
&X; R_5; \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
&Z; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,0}k_z); \\
&U; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,0}k_z); \\
&T; \{R_6, R_6\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&\quad \{R_7, R_7\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&\quad \{R_8, R_8\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&\quad \{R_9, R_9\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&S; \{R_5, R_6\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
&R; \{R_6, R_6\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&\quad \{R_7, R_7\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&\quad \{R_8, R_8\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&\quad \{R_9, R_9\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&P; \{R_2, R_2\}; \sigma_0(c_2k_y + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
&\quad \{R_4, R_4\}; \sigma_0(c_2k_y + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
&B; \{R_2, R_2\}; \sigma_0(c_2k_y + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
&\quad \{R_4, R_4\}; \sigma_0(c_2k_y + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
&C; \{R_2, R_4\}; \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
&E; \{R_2, R_2\}; \sigma_0(c_2k_x + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
&\quad \{R_4, R_4\}; \sigma_0(c_2k_x + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
&A; \{R_2, R_4\}; \sigma_0(c_2k_x + c_1) + c_3\sigma_3k_z; \\
&\Lambda; R_5; \quad \sigma_0(c_2k_z + c_1) + c_3\sigma_1k_x + c_4\sigma_3k_y; \\
&G; R_5; \quad \sigma_0(c_2k_z + c_1) + c_3\sigma_1k_x + c_4\sigma_3k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
D; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
P; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 \Gamma_{1,0} k_x + \sum_{i=1}^3 [k_z (c_{i,1} \Gamma_{0,i} + c_{i,2} \Gamma_{3,i}) + c_{i,3} k_x \Gamma_{2,i}]; \\
B; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 \Gamma_{1,0} k_x + \sum_{i=1}^3 [k_z (c_{i,1} \Gamma_{0,i} + c_{i,2} \Gamma_{3,i}) + c_{i,3} k_x \Gamma_{2,i}]; \\
\Sigma; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
E; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + c_4 \Gamma_{2,0} k_y + \sum_{i=1}^3 [k_z (c_{i,1} \Gamma_{0,i} + c_{i,2} \Gamma_{3,i}) + c_{i,3} k_y \Gamma_{1,i}]; \\
H; \{R_5\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
\{R_5\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
\{R_5\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
\{R_6\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
\{R_6\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
\{R_7\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
Q; \{R_5\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
\{R_5\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
\{R_5\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
\{R_6\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
\{R_6\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
\{R_7\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z;
\end{aligned}$$

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SG 30

 $\Gamma_o; \{C_{2z} | \frac{1}{2} 00\}, \{\sigma_y | 00 \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 


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$$\begin{aligned}
\Gamma; R_5; & \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
Y; \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \quad \{R_7, R_8\}; (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
X; R_5; & \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
Z; \{R_9, R_9\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,2} k_x + c_{i,2} \Gamma_{i,1} k_y + c_{i,3} \Gamma_{i,0} k_z); \\
U; \{R_9, R_9\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,2} k_x + c_{i,2} \Gamma_{i,1} k_y + c_{i,3} \Gamma_{i,0} k_z); \\
T; \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \quad \{R_7, R_8\}; (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
S; \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \quad \{R_7, R_8\}; (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
R; \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \quad \{R_7, R_8\}; (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
P; \{R_2, R_4\}; & \quad \sigma_0 (c_3 k_y + c_1) + (c_2 \sigma_1 - c_5 \sigma_2) k_x + c_4 \sigma_3 k_z; \\
B; \{R_2, R_4\}; & \quad \sigma_0 (c_3 k_y + c_1) + (c_2 \sigma_1 - c_5 \sigma_2) k_x + c_4 \sigma_3 k_z; \\
C; \{R_2, R_4\}; & \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z; \\
A; \{R_2, R_4\}; & \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z; \\
\Lambda; R_5; & \quad \sigma_0 (c_2 k_z + c_1) + c_3 \sigma_1 k_x + c_4 \sigma_3 k_y; \\
G; R_5; & \quad \sigma_0 (c_2 k_z + c_1) + c_3 \sigma_1 k_x + c_4 \sigma_3 k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
&D; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
&E; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
&H; \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
&Q; \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z;
\end{aligned}$$

SG 31

 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Y; \{R_5, R_6\}; & \quad (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
& \quad \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
X; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Z; \{R_9, R_9\}; & \quad c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_x + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_y + c_{i,2}\Gamma_{i,0}k_z); \\
U; \{R_9, R_9\}; & \quad c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_x + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_y + c_{i,2}\Gamma_{i,0}k_z); \\
T; \{R_5, R_6\}; & \quad c_2\sigma_3k_z + c_1\sigma_0; \\
& \quad \{R_7, R_8\}; c_2\sigma_3k_z + c_1\sigma_0; \\
S; \{R_5, R_6\}; & \quad (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
& \quad \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
R; \{R_5, R_6\}; & \quad c_2\sigma_3k_z + c_1\sigma_0; \\
& \quad \{R_7, R_8\}; c_2\sigma_3k_z + c_1\sigma_0; \\
P; \{R_2, R_4\}; & \quad \sigma_0(c_2k_y + c_1) + c_3\sigma_3k_z; \\
B; \{R_2, R_4\}; & \quad \sigma_0(c_2k_y + c_1) + c_3\sigma_3k_z; \\
C; \{R_2, R_4\}; & \quad \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
E; \{R_2, R_4\}; & \quad \sigma_0(c_2k_x + c_1) + c_3\sigma_3k_z; \\
A; \{R_2, R_2\}; & \quad \sigma_0(c_2k_x + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
& \quad \{R_4, R_4\}; \sigma_0(c_2k_x + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
\Lambda; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
G; R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
D; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
\Sigma; \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
A; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + c_4\Gamma_{2,0}k_y + \sum_{i=1}^3 [k_z(c_{i,1}\Gamma_{0,i} + c_{i,2}\Gamma_{3,i}) + c_{i,3}k_y\Gamma_{1,i}]; \\
H; \{R_5\}, \{R_6\}; & \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
& \quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
Q; \{R_5\}, \{R_6\}; & \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
& \quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
& \quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z;
\end{aligned}$$

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 $\Gamma_o; \{C_{2z}|\frac{1}{2}\frac{1}{2}0\}, \{\sigma_y|0\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
&\Gamma; R_5; \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
&Y; \{R_5, R_6\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
&X; \{R_5, R_6\}; (c_2\sigma_1 - c_4\sigma_2)k_x + c_3\sigma_3k_z + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_x + c_3\sigma_3k_z + c_1\sigma_0; \\
&Z; R_5; \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
&U; \{R_5, R_6\}; (c_2\sigma_1 - c_4\sigma_2)k_x + c_3\sigma_3k_z + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_x + c_3\sigma_3k_z + c_1\sigma_0; \\
&T; \{R_5, R_6\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
&S; \{R_9, R_9\}; c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_y + c_{i,3}\Gamma_{i,0}k_z); \\
&R; \{R_9, R_9\}; c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_y + c_{i,3}\Gamma_{i,0}k_z); \\
&D; \{R_2, R_4\}; \sigma_0(c_3k_y + c_1) + (c_2\sigma_1 - c_5\sigma_2)k_x + c_4\sigma_3k_z; \\
&P; \{R_2, R_4\}; \sigma_0(c_3k_y + c_1) + (c_2\sigma_1 - c_5\sigma_2)k_x + c_4\sigma_3k_z; \\
&C; \{R_2, R_4\}; \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
&E; \{R_2, R_4\}; \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
&\Lambda; R_5; \quad c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
&Q; R_{10}; \quad c_2\sigma_1k_x - c_4\sigma_2k_y + \sigma_0(c_3k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
&B; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
&A; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
&H; \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
&G; \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z;
\end{aligned}$$

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 $\Gamma_o; \{C_{2z}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{\sigma_y|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
&\Gamma; R_5; \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
&Y; \{R_5, R_6\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
&X; \{R_5, R_6\}; (c_2\sigma_1 - c_4\sigma_2)k_x + c_3\sigma_3k_z + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_x + c_3\sigma_3k_z + c_1\sigma_0; \\
&Z; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_y + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,0}k_z); \\
&U; \{R_5, R_6\}; c_2\sigma_3k_z + c_1\sigma_0; \\
&\quad \{R_7, R_8\}; c_2\sigma_3k_z + c_1\sigma_0; \\
&T; \{R_6, R_6\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&\quad \{R_7, R_7\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&\quad \{R_8, R_8\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&\quad \{R_9, R_9\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
&S; \{R_9, R_9\}; c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_y + c_{i,3}\Gamma_{i,0}k_z); \\
&R; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_x + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_y + c_{i,2}\Gamma_{i,0}k_z); \\
&D; \{R_2, R_4\}; \sigma_0(c_3k_y + c_1) + (c_2\sigma_1 - c_5\sigma_2)k_x + c_4\sigma_3k_z; \\
&P; \{R_2, R_4\}; \sigma_0(c_2k_y + c_1) + c_3\sigma_3k_z; \\
&B; \{R_2, R_2\}; \sigma_0(c_2k_y + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
&\quad \{R_4, R_4\}; \sigma_0(c_2k_y + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
&C; \{R_2, R_4\}; \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
&E; \{R_2, R_2\}; \sigma_0(c_2k_x + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
&\quad \{R_4, R_4\}; \sigma_0(c_2k_x + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
&A; \{R_2, R_4\}; \sigma_0(c_2k_x + c_1) + c_3\sigma_3k_z; \\
&\Lambda; R_5; \quad c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
&Q; R_{10}; \quad c_2\sigma_1k_x - c_4\sigma_2k_y + \sigma_0(c_3k_z + c_1);
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
B; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 \Gamma_{1,0} k_x + \sum_{i=1}^3 [k_z (c_{i,1} \Gamma_{0,i} + c_{i,2} \Gamma_{3,i}) + c_{i,3} k_x \Gamma_{2,i}]; \\
\Sigma; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
E; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + c_4 \Gamma_{2,0} k_y + \sum_{i=1}^3 [k_z (c_{i,1} \Gamma_{0,i} + c_{i,2} \Gamma_{3,i}) + c_{i,3} k_y \Gamma_{1,i}]; \\
H; \{R_5\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_5\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_5\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_6\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_6\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_7\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
G; \{R_5\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_5\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_5\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_6\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_6\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_7\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z;
\end{aligned}$$

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SG 34

 $\Gamma_o; \{C_{2z} | \frac{1}{2} \frac{1}{2} 0\}, \{\sigma_y | 0 \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 


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$$\begin{aligned}
\Gamma; R_5; & \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
Y; \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
X; \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
Z; \{R_9, R_9\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,2} k_x + c_{i,2} \Gamma_{i,1} k_y + c_{i,3} \Gamma_{i,0} k_z); \\
U; \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
T; \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
S; \{R_9, R_9\}; & \quad c_1 \Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,2} k_x + c_{i,2} \Gamma_{i,1} k_y + c_{i,3} \Gamma_{i,0} k_z); \\
R; R_5; & \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
D; \{R_2, R_4\}; & \quad \sigma_0 (c_3 k_y + c_1) + (c_2 \sigma_1 - c_5 \sigma_2) k_x + c_4 \sigma_3 k_z; \\
B; \{R_2, R_4\}; & \quad \sigma_0 (c_3 k_y + c_1) + (c_2 \sigma_1 - c_5 \sigma_2) k_x + c_4 \sigma_3 k_z; \\
C; \{R_2, R_4\}; & \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z; \\
A; \{R_2, R_4\}; & \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z; \\
\Lambda; R_5; & \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + \sigma_0 (c_4 k_z + c_1); \\
Q; R_{10}; & \quad c_2 \sigma_1 k_x - c_4 \sigma_2 k_y + \sigma_0 (c_3 k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
&P; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
&E; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
&H; \{R_5\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
&G; \{R_5\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z;
\end{aligned}$$

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SG 35

 $\Gamma_o^b; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 


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$$\begin{aligned}
&\Gamma; R_5; \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
&Y; R_5; \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
&Z; R_5; \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
&T; R_5; \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
&S; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_2 \sigma_3 k_z + c_1 \sigma_0; \\
&R; \{R_2, R_4\}; \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_2 \sigma_3 k_z + c_1 \sigma_0; \\
&\Lambda; R_5; \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + \sigma_0 (c_4 k_z + c_1); \\
&H; R_5; \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + \sigma_0 (c_4 k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&D; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
&A; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
&\Delta; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
&B; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
&G; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
&F; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
&E; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
&C; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y;
\end{aligned}$$

SG 36

 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Y; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Z; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_x + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_y + c_{i,2}\Gamma_{i,0}k_z); \\
T; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_x + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_y + c_{i,2}\Gamma_{i,0}k_z); \\
S; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\
R; \{R_5, R_5\}; & (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_7, R_7\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
\Lambda; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
H; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
A; \{R_2, R_2\}; & \sigma_0(c_2k_x + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
& \{R_4, R_4\}; \sigma_0(c_2k_x + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
B; \{R_2, R_4\}; & \sigma_0(c_2k_y + c_1) + c_3\sigma_3k_z; \\
G; \{R_2, R_4\}; & \sigma_0(c_2k_y + c_1) + c_3\sigma_3k_z; \\
E; \{R_2, R_2\}; & \sigma_0(c_2k_x + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z; \\
& \{R_4, R_4\}; \sigma_0(c_2k_x + c_1) + (c_4\sigma_1 - c_5\sigma_2 + c_3\sigma_3)k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
D; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\
A; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + c_4\Gamma_{2,0}k_y + \sum_{i=1}^3 [k_z(c_{i,1}\Gamma_{0,i} + c_{i,2}\Gamma_{3,i}) + c_{i,3}k_y\Gamma_{1,i}]; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
F; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
E; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + c_4\Gamma_{2,0}k_y + \sum_{i=1}^3 [k_z(c_{i,1}\Gamma_{0,i} + c_{i,2}\Gamma_{3,i}) + c_{i,3}k_y\Gamma_{1,i}]; \\
C; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y;
\end{aligned}$$

SG 37

 $\Gamma_o^b; \{C_{2z}|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Y; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Z; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_y + c_{i,3}\Gamma_{i,0}k_z); \\
T; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_y + c_{i,3}\Gamma_{i,0}k_z); \\
S; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\
R; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\
\Lambda; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
H; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
A; \{R_2, R_4\}; & \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
B; \{R_2, R_4\}; & \sigma_0(c_2k_y + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_x + c_4\sigma_3k_z; \\
G; \{R_2, R_4\}; & \sigma_0(c_2k_y + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_x + c_4\sigma_3k_z; \\
E; \{R_2, R_4\}; & \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$D; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \sum_{i=1}^2 \sigma_i(c_{i,1} k_x + c_{i,2} k_y);$$

$$\Sigma; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y;$$

$$\Delta; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x;$$

$$F; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x;$$

$$C; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y;$$

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SG 38

$\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

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$$\Gamma; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_z + c_1 \sigma_0;$$

$$Y; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_z + c_1 \sigma_0;$$

$$Z; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_z + c_1 \sigma_0;$$

$$T; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_z + c_1 \sigma_0;$$

$$S; \{R_2, R_4\}; \sigma_3(c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0;$$

$$R; \{R_2, R_4\}; \sigma_3(c_2 k_x + c_3 k_y) + (c_4 \sigma_1 - c_5 \sigma_2) k_z + c_1 \sigma_0;$$

$$\Delta; R_5; \sigma_0(c_2 k_y + c_1) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$$

$$B; R_5; \sigma_0(c_2 k_y + c_1) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$$

$$G; R_5; \sigma_0(c_2 k_y + c_1) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$$

$$F; R_5; \sigma_0(c_2 k_y + c_1) + c_3 \sigma_3 k_x + c_4 \sigma_1 k_z;$$

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Accidental degeneracies on high symmetry line

$$\Lambda; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_2 k_x;$$

$$H; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_2 k_x;$$

$$A; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_z;$$

$$\Sigma; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_z;$$

$$E; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_z;$$

$$C; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_z;$$

SG 39

 $\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & c_2\sigma_3k_x + c_3\sigma_1k_z + c_1\sigma_0; \\
Y; R_5; & c_2\sigma_3k_x + c_3\sigma_1k_z + c_1\sigma_0; \\
Z; R_5; & c_2\sigma_3k_x + c_3\sigma_1k_z + c_1\sigma_0; \\
T; R_5; & c_2\sigma_3k_x + c_3\sigma_1k_z + c_1\sigma_0; \\
S; \{R_5, R_5\}; & \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_1\sigma_0; \\
& \{R_7, R_7\}; \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_1\sigma_0; \\
R; \{R_5, R_5\}; & \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_1\sigma_0; \\
& \{R_7, R_7\}; \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_1\sigma_0; \\
D; \{R_2, R_2\}; & \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + \sigma_0 (c_2k_z + c_1); \\
\Delta; R_5; & \sigma_0 (c_2k_y + c_1) + c_3\sigma_3k_x + c_4\sigma_1k_z; \\
B; R_5; & \sigma_0 (c_2k_y + c_1) + c_3\sigma_3k_x + c_4\sigma_1k_z; \\
G; R_5; & \sigma_0 (c_2k_y + c_1) + c_3\sigma_3k_x + c_4\sigma_1k_z; \\
F; R_5; & \sigma_0 (c_2k_y + c_1) + c_3\sigma_3k_x + c_4\sigma_1k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_2k_x; \\
H; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_2k_x; \\
A; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_z; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_z; \\
E; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_z; \\
C; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_z;
\end{aligned}$$

SG 40

 $\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & c_2\sigma_3k_x + c_3\sigma_1k_z + c_1\sigma_0; \\
Y; R_5; & c_2\sigma_3k_x + c_3\sigma_1k_z + c_1\sigma_0; \\
Z; \{R_5, R_6\}; & c_2\sigma_3k_y + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; c_2\sigma_3k_y + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
T; \{R_5, R_6\}; & c_2\sigma_3k_y + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; c_2\sigma_3k_y + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
S; \{R_2, R_4\}; & \sigma_3 (c_2k_x + c_3k_y) + (c_4\sigma_1 - c_5\sigma_2)k_z + c_1\sigma_0; \\
R; \{R_2, R_4\}; & \sigma_3 (c_2k_x + c_3k_y) + (c_4\sigma_1 - c_5\sigma_2)k_z + c_1\sigma_0; \\
A; \{R_5, R_7\}; & \sigma_0 (c_2k_x + c_1) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_z; \\
\Delta; R_5; & \sigma_0 (c_2k_y + c_1) + c_3\sigma_3k_x + c_4\sigma_1k_z; \\
F; R_5; & \sigma_0 (c_2k_y + c_1) + c_3\sigma_3k_x + c_4\sigma_1k_z; \\
E; \{R_5, R_7\}; & \sigma_0 (c_2k_x + c_1) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_2 k_x; \\
&H; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_2 k_x; \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_z; \\
&B; \{R_5\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + (c_4 \sigma_1 + c_5 \sigma_2) k_z; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + (c_4 \sigma_1 + c_5 \sigma_2) k_z; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
&G; \{R_5\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
&\quad \{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + (c_4 \sigma_1 + c_5 \sigma_2) k_z; \\
&\quad \{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y; \\
&\quad \{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + (c_4 \sigma_1 + c_5 \sigma_2) k_z; \\
&\quad \{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
&C; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_z;
\end{aligned}$$

SG 41

 $\Gamma_o^b; \{C_{2y}|000\}, \{\sigma_x|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_z + c_1\sigma_0; \\
Y; R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_z + c_1\sigma_0; \\
Z; \{R_5, R_6\}; & \quad c_2\sigma_3k_y + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
& \quad \{R_7, R_8\}; c_2\sigma_3k_y + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
T; \{R_5, R_6\}; & \quad c_2\sigma_3k_y + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
& \quad \{R_7, R_8\}; c_2\sigma_3k_y + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
S; \{R_5, R_5\}; & \quad \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_1\sigma_0; \\
& \quad \{R_7, R_7\}; \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_1\sigma_0; \\
R; \{R_5, R_5\}; & \quad \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_1\sigma_0; \\
& \quad \{R_7, R_7\}; \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_1\sigma_0; \\
D; \{R_2, R_2\}; & \quad \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + \sigma_0 (c_2k_z + c_1); \\
A; \{R_5, R_7\}; & \quad \sigma_0 (c_2k_x + c_1) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_z; \\
\Delta; R_5; & \quad \sigma_0 (c_2k_y + c_1) + c_3\sigma_3k_x + c_4\sigma_1k_z; \\
F; R_5; & \quad \sigma_0 (c_2k_y + c_1) + c_3\sigma_3k_x + c_4\sigma_1k_z; \\
E; \{R_5, R_7\}; & \quad \sigma_0 (c_2k_x + c_1) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_2k_x; \\
H; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_2k_x; \\
\Sigma; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_z; \\
B; \{R_5\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_x; \\
& \quad \{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
& \quad \{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y; \\
& \quad \{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y; \\
& \quad \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
& \quad \{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_x; \\
G; \{R_5\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_x; \\
& \quad \{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
& \quad \{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y; \\
& \quad \{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y; \\
& \quad \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
& \quad \{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_x; \\
C; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_z;
\end{aligned}$$

SG 42

 $\Gamma_o^f; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Y; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
X; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Z; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
L; \{R_2, R_2\}; & \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z) + c_1\sigma_0; \\
\Lambda; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0 (c_4k_z + c_1); \\
G; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0 (c_4k_z + c_1); \\
H; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0 (c_4k_z + c_1); \\
Q; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0 (c_4k_z + c_1);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
C; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
A; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
D; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
B; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
R; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x;
\end{aligned}$$

SG 43

 $\Gamma_o^f; \{C_{2z}|00\frac{1}{2}\}, \{\sigma_y|\frac{1}{2}00\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
Y; \{R_5, R_6\}; & (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
X; \{R_5, R_6\}; & (c_2\sigma_1 - c_4\sigma_2)k_x + c_3\sigma_3k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; (c_2\sigma_1 - c_4\sigma_2)k_x + c_3\sigma_3k_z + c_1\sigma_0; \\
Z; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,2}k_x + c_{i,2}\Gamma_{i,1}k_y + c_{i,3}\Gamma_{i,0}k_z); \\
L; \{R_2, R_2\}; & \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z) + c_1\sigma_0; \\
\Lambda; R_5; & \sigma_0 (c_2k_z + c_1) + c_3\sigma_1k_x + c_4\sigma_3k_y; \\
Q; R_5; & \sigma_0 (c_2k_z + c_1) + c_3\sigma_1k_x + c_4\sigma_3k_y; \\
C; \{R_2, R_4\}; & \sigma_0 (c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
A; \{R_2, R_4\}; & \sigma_0 (c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z; \\
D; \{R_2, R_4\}; & \sigma_0 (c_3k_y + c_1) + (c_2\sigma_1 - c_5\sigma_2)k_x + c_4\sigma_3k_z; \\
B; \{R_2, R_4\}; & \sigma_0 (c_3k_y + c_1) + (c_2\sigma_1 - c_5\sigma_2)k_x + c_4\sigma_3k_z;
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
G; \{R_5\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
& \{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
H; \{R_5\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
& \{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
R; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x;
\end{aligned}$$

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SG 44

$\Gamma_o^v; \{C_{2z}|000\}, \{\sigma_y|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
X; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
R; \{R_2, R_4\}; & \sigma_3 (c_2 k_x + c_4 k_z) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_1 \sigma_0; \\
S; \{R_2, R_4\}; & (c_2 \sigma_1 - c_5 \sigma_2) k_x + \sigma_3 (c_3 k_y + c_4 k_z) + c_1 \sigma_0; \\
T; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y) + c_2 \sigma_3 k_z + c_1 \sigma_0; \\
\Lambda; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + \sigma_0 (c_4 k_z + c_1); \\
G; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + \sigma_0 (c_4 k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x;
\end{aligned}$$

SG 45

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 $\Gamma_o^v; \{C_{2z}|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
X; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
R; \{R_5, R_5\}; & \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_z) + c_1\sigma_0; \\
& \{R_7, R_7\}; \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_z) + c_1\sigma_0; \\
S; \{R_5, R_5\}; & \sum_{i=1}^3 \sigma_i (c_{i,1}k_y + c_{i,2}k_z) + c_1\sigma_0; \\
& \{R_7, R_7\}; \sum_{i=1}^3 \sigma_i (c_{i,1}k_y + c_{i,2}k_z) + c_1\sigma_0; \\
T; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\
W; \{R_2, R_2\}; & (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_4, R_4\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
\Lambda; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
G; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
D; \{R_2, R_2\}; & \sigma_0(c_2k_x + c_1) + \sum_{i=1}^3 \sigma_i (c_{i,1}k_y + c_{i,2}k_z); \\
Q; \{R_2, R_2\}; & \sigma_0(c_2k_y + c_1) + \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_z);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
P; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
F; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
U; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x;
\end{aligned}$$

SG 46

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 $\Gamma_o^v; \{C_{2z}|000\}, \{\sigma_y|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
X; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
R; \{R_2, R_4\}; & \sigma_3(c_2k_x + c_4k_z) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_1\sigma_0; \\
S; \{R_5, R_5\}; & \sum_{i=1}^3 \sigma_i (c_{i,1}k_y + c_{i,2}k_z) + c_1\sigma_0; \\
& \{R_7, R_7\}; \sum_{i=1}^3 \sigma_i (c_{i,1}k_y + c_{i,2}k_z) + c_1\sigma_0; \\
T; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y) + c_2\sigma_3k_z + c_1\sigma_0; \\
W; \{R_2, R_4\}; & (c_2\sigma_1 - c_4\sigma_2)k_y + c_3\sigma_3k_z + c_1\sigma_0; \\
\Lambda; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
G; R_5; & c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
D; \{R_2, R_2\}; & \sigma_0(c_2k_x + c_1) + \sum_{i=1}^3 \sigma_i (c_{i,1}k_y + c_{i,2}k_z);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
P; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
F; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x; \\
U; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x;
\end{aligned}$$

SG 48

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$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$$\begin{aligned}
Y; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y(c_3\Gamma_{1,1} - c_4\Gamma_{2,1}) - c_5\Gamma_{0,2}k_z; \\
X; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_x(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) - c_5\Gamma_{0,2}k_y + c_3\Gamma_{3,1}k_z; \\
Z; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1}); \\
U; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y(c_3\Gamma_{1,1} - c_4\Gamma_{2,1}) - c_5\Gamma_{0,2}k_z; \\
T; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_x(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) - c_5\Gamma_{0,2}k_y + c_3\Gamma_{3,1}k_z; \\
S; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1});
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
D; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z(c_6\Gamma_{2,3} + c_7\Gamma_{1,0}); \\
B; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\
C; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z(c_6\Gamma_{2,3} + c_7\Gamma_{1,0}); \\
A; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\
H; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_y(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\
G; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_y(c_6\Gamma_{2,3} + c_7\Gamma_{1,0});
\end{aligned}$$

SG 49

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$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$$\begin{aligned}
Z; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1}); \\
U; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1}); \\
T; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1}); \\
R; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1});
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
P; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\
B; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\
E; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\
A; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2});
\end{aligned}$$

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$Y; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y(c_3\Gamma_{1,1} - c_4\Gamma_{2,1}) - c_5\Gamma_{0,2}k_z;$   
 $X; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + k_x(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_y - c_5\Gamma_{0,2}k_z;$   
 $U; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + k_x(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_y - c_5\Gamma_{0,2}k_z;$   
 $T; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y(c_3\Gamma_{1,1} - c_4\Gamma_{2,1}) - c_5\Gamma_{0,2}k_z;$   
 $S; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1});$   
 $R; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1});$

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Accidental degeneracies on high symmetry line

$D; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z(c_6\Gamma_{2,3} + c_7\Gamma_{1,0});$   
 $P; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z(c_6\Gamma_{2,3} + c_7\Gamma_{1,0});$   
 $C; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z(c_6\Gamma_{2,3} + c_7\Gamma_{1,0});$   
 $E; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z(c_6\Gamma_{2,3} + c_7\Gamma_{1,0});$   
 $H; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_y(c_6\Gamma_{2,1} + c_7\Gamma_{2,2});$   
 $G; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_y(c_6\Gamma_{2,3} + c_7\Gamma_{1,0});$

## SG 51

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 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|000\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$$\begin{aligned} Z; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_y + k_z (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\ U; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_y + k_z (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\ T; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_y + k_z (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\ R; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_y + k_z (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\ E; \{R_9, R_9\}; & \Gamma_{0,0} (c_2k_x + c_1) + c_3\Gamma_{0,1}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_z; \\ A; \{R_9, R_9\}; & \Gamma_{0,0} (c_2k_x + c_1) + c_3\Gamma_{0,1}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_z; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} P; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_z (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\ B; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_z (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \end{aligned}$$

## SG 52

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 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$$\begin{aligned} Y; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y (c_3\Gamma_{1,1} - c_4\Gamma_{2,1}) - c_5\Gamma_{0,2}k_z; \\ X; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_x (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) - c_5\Gamma_{0,2}k_y + c_3\Gamma_{3,1}k_z; \\ Z; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_y + k_z (c_3\Gamma_{1,1} - c_4\Gamma_{2,1}); \\ U; \{R_9, R_9\}; & c_1\Gamma_{0,0} + k_z (c_3\Gamma_{1,1} - c_4\Gamma_{2,1} + c_2\Gamma_{3,1}); \\ & \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + k_z (c_3\Gamma_{1,1} - c_4\Gamma_{2,1} + c_2\Gamma_{3,1}); \\ S; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z (c_3\Gamma_{1,1} - c_5\Gamma_{2,1}); \\ R; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_z (c_3\Gamma_{1,1} - c_4\Gamma_{2,1}); \\ P; \{R_9, R_9\}; & \Gamma_{0,0} (c_2k_y + c_1) + c_3\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}\Gamma_{i,2}k_z; \\ A; \{R_9, R_9\}; & \Gamma_{0,0} (c_2k_x + c_1) + c_3\Gamma_{0,1}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_z; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} D; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z (c_6\Gamma_{2,3} + c_7\Gamma_{1,0}); \\ B; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_z (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\ C; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z (c_6\Gamma_{2,3} + c_7\Gamma_{1,0}); \\ E; \{R_6, R_8\}, \{R_7, R_9\}; & \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_z (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\ H; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_y (c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\ G; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_y (c_6\Gamma_{2,3} + c_7\Gamma_{1,0}); \end{aligned}$$

SG 53

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 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|\frac{1}{2}00\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} Y; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y (c_3\Gamma_{1,1} - c_4\Gamma_{2,1}) - c_5\Gamma_{0,2}k_z; \\ Z; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_y + k_z (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\ U; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_y + k_z (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\ S; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y (c_3\Gamma_{1,1} - c_4\Gamma_{2,1}) - c_5\Gamma_{0,2}k_z; \\ A; & \{R_9, R_9\}; \Gamma_{0,0} (c_2k_x + c_1) + c_3\Gamma_{0,1}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_z; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} P; & \{R_5, R_6\}, \{R_7, R_8\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_z (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\ B; & \{R_5, R_6\}, \{R_7, R_8\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_z (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\ C; & \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z (c_6\Gamma_{2,3} + c_7\Gamma_{1,0}); \\ E; & \{R_6, R_9\}, \{R_7, R_8\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_z (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\ H; & \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_y (c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\ Q; & \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_y (c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \end{aligned}$$

SG 54

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 $\Gamma_o; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|000\}, \{I|0\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} X; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_y + c_3\Gamma_{3,1}k_z + \sum_{i=1}^2 c_{i,1}k_x\Gamma_{i,1}; \\ Z; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_y + k_z (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\ U; & \{R_9, R_9\}; c_1\Gamma_{0,0} + k_z (c_3\Gamma_{1,1} - c_4\Gamma_{2,1} + c_2\Gamma_{3,1}); \\ & \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + k_z (c_3\Gamma_{1,1} - c_4\Gamma_{2,1} + c_2\Gamma_{3,1}); \\ T; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_y + k_z (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\ S; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_y + c_3\Gamma_{3,1}k_z + \sum_{i=1}^2 c_{i,1}k_x\Gamma_{i,1}; \\ R; & \{R_9, R_9\}; c_1\Gamma_{0,0} + k_z (c_3\Gamma_{1,1} - c_4\Gamma_{2,1} + c_2\Gamma_{3,1}); \\ & \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + k_z (c_3\Gamma_{1,1} - c_4\Gamma_{2,1} + c_2\Gamma_{3,1}); \\ P; & \{R_9, R_9\}; \Gamma_{0,0} (c_2k_y + c_1) + c_3\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}\Gamma_{i,2}k_z; \\ E; & \{R_9, R_9\}; \Gamma_{0,0} (c_2k_x + c_1) + c_3\Gamma_{0,1}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_z; \\ A; & \{R_9, R_9\}; \Gamma_{0,0} (c_2k_x + c_1) + c_3\Gamma_{0,1}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_z; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} D; & \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z (c_6\Gamma_{2,3} + c_7\Gamma_{1,0}); \\ B; & \{R_5, R_6\}, \{R_7, R_8\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_z (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\ Q; & \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_y (c_6\Gamma_{2,3} + c_7\Gamma_{1,0}); \\ G; & \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_y (c_6\Gamma_{2,3} + c_7\Gamma_{1,0}); \end{aligned}$$

SG 55

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
Y; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_y(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z; \\
X; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_x(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z; \\
U; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_x(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z; \\
T; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_y(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z; \\
S; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + c_5\Gamma_{0,2}k_xk_z + c_6\Gamma_{0,1}k_yk_z + [(\alpha_1\Gamma_{+,3} + c_7\Gamma_{3,3})k_xk_y + h.c.]; \\
& \{R_{19}, R_{19}\}; \Gamma_{0,0}(c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + c_5\Gamma_{0,2}k_xk_z + c_6\Gamma_{0,1}k_yk_z + [(\alpha_1\Gamma_{+,3} + c_7\Gamma_{3,3})k_xk_y + h.c.]; \\
R; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + c_5\Gamma_{0,2}k_xk_z + c_6\Gamma_{0,1}k_yk_z + [(\alpha_1\Gamma_{+,3} + c_7\Gamma_{3,3})k_xk_y + h.c.]; \\
& \{R_{19}, R_{19}\}; \Gamma_{0,0}(c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + c_5\Gamma_{0,2}k_xk_z + c_6\Gamma_{0,1}k_yk_z + [(\alpha_1\Gamma_{+,3} + c_7\Gamma_{3,3})k_xk_y + h.c.]; \\
D; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_y + c_1) + c_3\Gamma_{0,1}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_x; \\
P; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_y + c_1) + c_3\Gamma_{0,1}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_x; \\
C; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_x + c_1) + c_3\Gamma_{0,2}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_y; \\
E; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_x + c_1) + c_3\Gamma_{0,2}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_y; \\
Q; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_z + c_1) + c_3\Gamma_{0,2}k_x + c_4\Gamma_{0,1}k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
H; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_y(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\
G; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3});
\end{aligned}$$

SG 56

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
Y; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y(c_3\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
X; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_x(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_y; \\
Z; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1}); \\
U; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_x; \\
& \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_x; \\
T; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y; \\
& \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y; \\
S; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y; \\
R; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + c_5\Gamma_{0,2}k_xk_z + c_6\Gamma_{0,1}k_yk_z + [(\alpha_1\Gamma_{+,3} + c_7\Gamma_{3,3})k_xk_y + h.c.]; \\
& \{R_{19}, R_{19}\}; \Gamma_{0,0}(c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + c_5\Gamma_{0,2}k_xk_z + c_6\Gamma_{0,1}k_yk_z + [(\alpha_1\Gamma_{+,3} + c_7\Gamma_{3,3})k_xk_y + h.c.]; \\
P; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_y + c_1) + c_3\Gamma_{0,3}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,2}k_x; \\
E; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_x + c_1) + c_3\Gamma_{0,3}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y; \\
H; \{R_5, R_5\}; & \Gamma_{0,0}(c_2k_z + c_1) + c_3\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_y; \\
Q; \{R_5, R_5\}; & \Gamma_{0,0}(c_2k_z + c_1) + c_3\Gamma_{0,1}k_x + c_4\Gamma_{0,3}k_y; \\
G; \{R_5, R_5\}; & \Gamma_{0,0}(c_2k_z + c_1) + c_3\Gamma_{0,3}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
D; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}); \\
B; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_z (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}); \\
C; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}); \\
A; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_z (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2});
\end{aligned}$$

SG 57

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|0\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
Y; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + k_y (c_2 \Gamma_{1,1} - c_4 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_z; \\
X; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + k_x (c_2 \Gamma_{1,1} - c_4 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_y; \\
U; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + k_x (c_2 \Gamma_{1,1} - c_4 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_y; \\
T; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + k_y (c_2 \Gamma_{1,1} - c_4 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_z; \\
S; \{R_9, R_9\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 c_{i,1} \Gamma_{i,1} k_y + c_2 \Gamma_{0,2} k_z; \\
& \{R_{10}, R_{10}\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 c_{i,1} \Gamma_{i,1} k_y + c_2 \Gamma_{0,2} k_z; \\
R; \{R_9, R_9\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 c_{i,1} \Gamma_{i,1} k_y + c_2 \Gamma_{0,2} k_z; \\
& \{R_{10}, R_{10}\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 c_{i,1} \Gamma_{i,1} k_y + c_2 \Gamma_{0,2} k_z; \\
C; \{R_9, R_9\}; & \Gamma_{0,0} (c_2 k_x + c_1) + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_y + c_3 \Gamma_{0,2} k_z; \\
E; \{R_9, R_9\}; & \Gamma_{0,0} (c_2 k_x + c_1) + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_y + c_3 \Gamma_{0,2} k_z; \\
G; \{R_5, R_5\}; & \Gamma_{0,0} (c_2 k_z + c_1) + c_3 \Gamma_{0,3} k_y + \sum_{i=1}^3 c_{i,1} \Gamma_{i,1} k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
D; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}); \\
P; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}); \\
H; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_y (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}); \\
Q; \{R_5, R_5\}, \{R_6, R_6\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,1} \Gamma_{2,i}) k_x; \\
& \{R_5, R_5\}, \{R_7, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,1} \Gamma_{2,i}) k_y; \\
& \{R_5, R_5\}, \{R_8, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z; \\
& \{R_6, R_6\}, \{R_7, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z; \\
& \{R_6, R_6\}, \{R_8, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,1} \Gamma_{2,i}) k_y; \\
& \{R_7, R_7\}, \{R_8, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,1} \Gamma_{2,i}) k_x;
\end{aligned}$$



SG 58

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|00\frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$$\begin{aligned}
Y; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_y (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z; \\
X; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_x (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z; \\
Z; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z (c_3\Gamma_{1,1} - c_5\Gamma_{2,1}); \\
S; \{R_9, R_9\}; & \Gamma_{0,0} (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + c_5\Gamma_{0,2}k_xk_z + c_6\Gamma_{0,1}k_yk_z + [(\alpha_1\Gamma_{+,3} + c_7\Gamma_{3,3})k_xk_y + h.c.]; \\
& \{R_{19}, R_{19}\}; & \Gamma_{0,0} (c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + c_5\Gamma_{0,2}k_xk_z + c_6\Gamma_{0,1}k_yk_z + [(\alpha_1\Gamma_{+,3} + c_7\Gamma_{3,3})k_xk_y + h.c.]; \\
R; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y; \\
D; \{R_9, R_9\}; & \Gamma_{0,0} (c_2k_y + c_1) + c_3\Gamma_{0,1}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_x; \\
C; \{R_9, R_9\}; & \Gamma_{0,0} (c_2k_x + c_1) + c_3\Gamma_{0,2}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_y; \\
Q; \{R_9, R_9\}; & \Gamma_{0,0} (c_2k_z + c_1) + c_3\Gamma_{0,2}k_x + c_4\Gamma_{0,1}k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
P; \{R_6, R_8\}, \{R_7, R_9\}; & \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\
B; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z (c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\
E; \{R_6, R_9\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\
A; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z (c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\
H; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_y (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\
G; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x (c_4\Gamma_{1,0} + c_5\Gamma_{2,3});
\end{aligned}$$

SG 59

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 $\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$$\begin{aligned}
Y; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y (c_3\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
X; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_x (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_y; \\
U; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_x (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_y; \\
T; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y (c_3\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
S; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x - c_3\Gamma_{0,2}k_y; \\
R; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x - c_3\Gamma_{0,2}k_y; \\
H; \{R_5, R_5\}; & \Gamma_{0,0} (c_2k_z + c_1) + c_3\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_y; \\
Q; \{R_5, R_5\}; & \Gamma_{0,0} (c_4k_z + c_1) + c_2\Gamma_{0,1}k_x + c_3\Gamma_{0,3}k_y; \\
G; \{R_5, R_5\}; & \Gamma_{0,0} (c_2k_z + c_1) + c_3\Gamma_{0,3}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
D; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\
P; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\
C; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\
A; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y (c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z (c_6\Gamma_{2,3} + c_7\Gamma_{1,0});
\end{aligned}$$

$\Gamma_o; \{C_{2z}|000\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}0\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
Y; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y(c_3\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
X; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + k_x(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z; \\
Z; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1}); \\
T; \{R_9, R_9\}; & c_1\Gamma_{0,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y; \\
& \{R_{10}, R_{10}\}; & c_1\Gamma_{0,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y; \\
S; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_x; \\
& \{R_{10}, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_x; \\
R; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y; \\
& \{R_{10}, R_{10}\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y; \\
D; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_y + c_1) + c_3\Gamma_{0,1}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_x; \\
E; \{R_9, R_9\}; & \Gamma_{0,0}(c_2k_x + c_1) + c_3\Gamma_{0,3}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y; \\
H; \{R_5, R_5\}; & \Gamma_{0,0}(c_2k_z + c_1) + c_3\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_y;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
P; \{R_6, R_8\}, \{R_7, R_9\}; & \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\
B; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\
C; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\
A; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\
Q; \{R_5, R_5\}, \{R_6, R_6\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i})k_y; \\
& \{R_5, R_5\}, \{R_7, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i})k_x; \\
& \{R_5, R_5\}, \{R_8, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z; \\
& \{R_6, R_6\}, \{R_7, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z; \\
& \{R_6, R_6\}, \{R_8, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i})k_x; \\
& \{R_7, R_7\}, \{R_8, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i})k_y; \\
G; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3});
\end{aligned}$$

SG 61

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 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
Y; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x + k_y (c_3\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
X; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + k_x (c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z; \\
Z; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_y + k_z (c_3\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
U; & \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_z; \\
& \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_z; \\
T; & \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y; \\
& \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y; \\
S; & \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_x; \\
& \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_x; \\
D; & \{R_9, R_9\}; \Gamma_{0,0} (c_2k_y + c_1) + c_3\Gamma_{0,1}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_x; \\
A; & \{R_9, R_9\}; \Gamma_{0,0} (c_2k_x + c_1) + c_3\Gamma_{0,1}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_z; \\
H; & \{R_9, R_9\}; \Gamma_{0,0} (c_2k_z + c_1) + c_3\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
P; & \{R_6, R_6\}, \{R_7, R_7\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y; \\
& \{R_6, R_6\}, \{R_8, R_8\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_z (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_6, R_6\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_7, R_7\}, \{R_8, R_8\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_7, R_7\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_z (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_8, R_8\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y; \\
B; & \{R_5, R_6\}, \{R_7, R_8\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_z (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\
C; & \{R_5, R_6\}, \{R_7, R_8\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y (c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\
E; & \{R_6, R_6\}, \{R_7, R_7\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x; \\
& \{R_6, R_6\}, \{R_8, R_8\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_6, R_6\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_z (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_7, R_7\}, \{R_8, R_8\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_z (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_7, R_7\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_8, R_8\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x; \\
Q; & \{R_6, R_6\}, \{R_7, R_7\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z; \\
& \{R_6, R_6\}, \{R_8, R_8\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_6, R_6\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_y (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_7, R_7\}, \{R_8, R_8\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_y (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_7, R_7\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x (c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_8, R_8\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z; \\
G; & \{R_5, R_6\}, \{R_7, R_8\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x (c_4\Gamma_{1,0} + c_5\Gamma_{2,3});
\end{aligned}$$

SG 62

 $\Gamma_o; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
Y; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + k_y(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z; \\
X; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + k_x(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_y; \\
Z; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
U; & \{R_9, R_9\}; \Gamma_{0,0}(c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + c_5\Gamma_{0,1}k_xk_y + c_6\Gamma_{0,2}k_yk_z + [(\alpha_1\Gamma_{+,3} + c_7\Gamma_{3,3})k_xk_z + h.c.]; \\
& \{R_{19}, R_{19}\}; \Gamma_{0,0}(c_2k_x^2 + c_3k_y^2 + c_4k_z^2 + c_1) + c_5\Gamma_{0,1}k_xk_y + c_6\Gamma_{0,2}k_yk_z + [(\alpha_1\Gamma_{+,3} + c_7\Gamma_{3,3})k_xk_z + h.c.]; \\
T; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_y + c_3\Gamma_{0,2}k_z; \\
S; & \{R_9, R_9\}; c_1\Gamma_{0,0} + \sum_{i=1}^3 c_{i,1}k_y\Gamma_{i,1} + c_2\Gamma_{0,2}k_z; \\
& \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + \sum_{i=1}^3 c_{i,1}k_y\Gamma_{i,1} + c_2\Gamma_{0,2}k_z; \\
R; & \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z; \\
& \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z; \\
P; & \{R_9, R_9\}; \Gamma_{0,0}(c_2k_y + c_1) + c_3\Gamma_{0,1}k_x + c_4\Gamma_{0,3}k_z; \\
C; & \{R_5, R_5\}; \Gamma_{0,0}(c_2k_x + c_1) + c_3\Gamma_{0,1}k_z + \sum_{i=1}^3 c_{i,1}k_y\Gamma_{i,3}; \\
E; & \{R_9, R_9\}; \Gamma_{0,0}(c_2k_x + c_1) + c_3\Gamma_{0,1}k_y + c_4\Gamma_{0,3}k_z; \\
A; & \{R_9, R_9\}; \Gamma_{0,0}(c_2k_x + c_1) + c_3\Gamma_{0,1}k_y + \sum_{i=1}^3 c_{i,1}k_z\Gamma_{i,3}; \\
G; & \{R_5, R_5\}; \Gamma_{0,0}(c_2k_z + c_1) + c_3\Gamma_{0,3}k_y + \sum_{i=1}^3 c_{i,1}k_x\Gamma_{i,1};
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
D; & \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\
B; & \{R_5, R_6\}, \{R_7, R_8\}; \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_z(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}); \\
H; & \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_y(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\
Q; & \{R_5, R_5\}, \{R_6, R_6\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z; \\
& \{R_5, R_5\}, \{R_7, R_7\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_y(c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_5, R_5\}, \{R_8, R_8\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x(c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_6, R_6\}, \{R_7, R_7\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x(c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_6, R_6\}, \{R_8, R_8\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_y(c_4\Gamma_{1,0} + \sum_{i=1}^3 c_{i,1}\Gamma_{2,i}); \\
& \{R_7, R_7\}, \{R_8, R_8\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z;
\end{aligned}$$

SG 63

 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
Z; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_x + k_z(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
T; & \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_x + k_z(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
R; & \{R_9, R_9\}; c_1\Gamma_{0,0} + \Gamma_{0,2}(c_2k_x + c_3k_y) + \sum_{i=1}^3 c_{i,1}k_z\Gamma_{i,1}; \\
B; & \{R_9, R_9\}; \Gamma_{0,0}(c_3k_y + c_1) + c_2\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}k_z\Gamma_{i,3}; \\
G; & \{R_9, R_9\}; \Gamma_{0,0}(c_3k_y + c_1) + c_2\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}k_z\Gamma_{i,3};
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
A; & \{R_5, R_6\}, \{R_7, R_8\}; \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_z(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\
E; & \{R_5, R_6\}, \{R_7, R_8\}; \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_z(c_4\Gamma_{2,1} + c_5\Gamma_{2,2});
\end{aligned}$$

SG 64

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 $\Gamma_o^b; \{C_{2z}|00\frac{1}{2}\}, \{C_{2y}|00\frac{1}{2}\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$$\begin{aligned} Z; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_3\Gamma_{0,2}k_x + k_z(c_2\Gamma_{1,1} + c_4\Gamma_{2,1}); \\ T; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} + c_3\Gamma_{0,2}k_x + k_z(c_2\Gamma_{1,1} + c_4\Gamma_{2,1}); \\ S; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y); \\ B; \{R_9, R_9\}; & \Gamma_{0,0}(c_3k_y + c_1) + c_2\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}k_z\Gamma_{i,3}; \\ G; \{R_9, R_9\}; & \Gamma_{0,0}(c_3k_y + c_1) + c_2\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}k_z\Gamma_{i,3}; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} D; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + \Gamma_{1,0}(c_4k_x + c_5k_y) + \sum_{i=1}^3 \Gamma_{2,i}(c_{i,1}k_x + c_{i,2}k_y); \\ A; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_z(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\ E; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_z(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \end{aligned}$$

SG 66

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 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$$\begin{aligned} Z; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1}); \\ T; \{R_{13}, R_{14}\}; & c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1}); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} A; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\ B; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\ G; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\ E; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \end{aligned}$$

SG 67

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 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$$\begin{aligned} S; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y); \\ R; \{R_9, R_9\}; & c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$D; \{R_2, R_2\}, \{R_4, R_4\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + \Gamma_{1,0}(c_4k_x + c_5k_y) + \sum_{i=1}^3 \Gamma_{2,i}(c_{i,1}k_x + c_{i,2}k_y);$$

SG 68

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 $\Gamma_o^b; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 
 $Z; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1});$ 
 $T; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1});$ 
 $S; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y);$ 
 $R; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_x + c_{i,2}k_y);$ 


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Accidental degeneracies on high symmetry line

 $D; \{R_2, R_2\}, \{R_4, R_4\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + \Gamma_{1,0}(c_4k_x + c_5k_y) + \sum_{i=1}^3 \Gamma_{2,i}(c_{i,1}k_x + c_{i,2}k_y);$ 
 $A; \{R_5, R_7\}, \{R_6, R_8\}; \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2});$ 
 $B; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2});$ 
 $G; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2});$ 
 $E; \{R_5, R_7\}, \{R_6, R_8\}; \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2});$ 

SG 70

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 $\Gamma_o^f; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 
 $Y; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + k_y(c_2\Gamma_{1,1} - c_5\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z;$ 
 $X; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + k_x(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}) + c_3\Gamma_{3,1}k_y - c_5\Gamma_{0,2}k_z;$ 
 $Z; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} + c_2\Gamma_{3,1}k_x - c_4\Gamma_{0,2}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1});$ 


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Accidental degeneracies on high symmetry line

 $G; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_y(c_6\Gamma_{2,3} + c_7\Gamma_{1,0});$ 
 $H; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_y(c_6\Gamma_{2,1} + c_7\Gamma_{2,2});$ 
 $C; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z(c_6\Gamma_{2,3} + c_7\Gamma_{1,0});$ 
 $A; \{R_5, R_7\}, \{R_6, R_8\}; \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2});$ 
 $D; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}) + k_z(c_6\Gamma_{2,3} + c_7\Gamma_{1,0});$ 
 $B; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2});$

## 9. SG 71-80

## SG 72

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 $\Gamma_o^v; \{C_{2z}|000\}, \{C_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$$R; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_y + \sum_{i=1}^3 \Gamma_{i,1} (c_{i,1}k_x + c_{i,2}k_z);$$

$$S; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + \sum_{i=1}^3 \Gamma_{i,1} (c_{i,1}k_y + c_{i,2}k_z);$$

$$W; \{R_5, R_5\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,3}k_x + c_3\Gamma_{0,1}k_y + \sum_{i=1}^3 c_{i,1}\Gamma_{i,2}k_z;$$

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Accidental degeneracies on high symmetry line

$$D; \{R_2, R_2\}, \{R_4, R_4\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + \Gamma_{1,0} (c_4k_y + c_5k_z) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1}k_y + c_{i,2}k_z);$$

$$Q; \{R_2, R_2\}, \{R_4, R_4\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + \Gamma_{1,0} (c_4k_x + c_5k_z) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1}k_x + c_{i,2}k_z);$$

## SG 73

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 $\Gamma_o^v; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$R; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_y + \sum_{i=1}^3 \Gamma_{i,1} (c_{i,1}k_x + c_{i,2}k_z);$$

$$S; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + \sum_{i=1}^3 \Gamma_{i,1} (c_{i,1}k_y + c_{i,2}k_z);$$

$$T; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1} (c_{i,1}k_x + c_{i,2}k_y);$$

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Accidental degeneracies on high symmetry line

$$P; \{R_5, R_5\}, \{R_7, R_7\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + \Gamma_{1,0} (c_4k_x + c_5k_y) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1}k_x + c_{i,2}k_y);$$

$$D; \{R_5, R_5\}, \{R_7, R_7\}; \Gamma_{0,0} (c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + \Gamma_{1,0} (c_4k_y + c_5k_z) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1}k_y + c_{i,2}k_z);$$

$$Q; \{R_5, R_5\}, \{R_7, R_7\}; \Gamma_{0,0} (c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + \Gamma_{1,0} (c_4k_x + c_5k_z) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1}k_x + c_{i,2}k_z);$$

## SG 74

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 $\Gamma_o^v; \{C_{2z}|\frac{1}{2}0\frac{1}{2}\}, \{C_{2y}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$$T; \{R_9, R_9\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_z + \sum_{i=1}^3 \Gamma_{i,1} (c_{i,1}k_x + c_{i,2}k_y);$$

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Accidental degeneracies on high symmetry line

$$P; \{R_5, R_5\}, \{R_7, R_7\}; \Gamma_{0,0} (c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + \Gamma_{1,0} (c_4k_x + c_5k_y) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1}k_x + c_{i,2}k_y);$$

$\Gamma_q; \{C_{4z}^+|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
&\Gamma; \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&M; \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&Z; \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&A; \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&R; \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + [(\alpha_1k_x + \alpha_2k_y)\sigma_+ + h.c.]; \\
&X; \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + [(\alpha_1k_x + \alpha_2k_y)\sigma_+ + h.c.];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&\quad \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&V; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&\quad \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&W; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);
\end{aligned}$$



$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{4}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
\Gamma; & \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
M; & \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
Z; & \{R_1, R_1\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_3, R_7\}; c_2\sigma_3k_z + c_1\sigma_0; \\
& \{R_5, R_5\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
A; & \{R_1, R_1\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_3, R_7\}; c_2\sigma_3k_z + c_1\sigma_0; \\
& \{R_5, R_5\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
R; & \{R_1, R_1\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_3, R_3\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
X; & \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + [(\alpha_1k_x + \alpha_2k_y)\sigma_+ + h.c.]; \\
U; & \{R_2, R_2\}; \sigma_0(c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_z; \\
S; & \{R_2, R_2\}; \sigma_0(c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_z; \\
T; & \{R_2, R_2\}; \sigma_0(c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
V; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
W; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | 00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
&\Gamma; \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&M; \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&Z; \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&A; \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&R; \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + [(\alpha_1k_x + \alpha_2k_y)\sigma_+ + h.c.]; \\
&X; \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + [(\alpha_1k_x + \alpha_2k_y)\sigma_+ + h.c.];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&\quad \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&V; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&\quad \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
&W; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | 00 \frac{3}{4}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
\Gamma; & \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
M; & \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
Z; & \{R_1, R_1\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_3, R_7\}; c_2\sigma_3k_z + c_1\sigma_0; \\
& \{R_5, R_5\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
A; & \{R_1, R_1\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_3, R_7\}; c_2\sigma_3k_z + c_1\sigma_0; \\
& \{R_5, R_5\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
R; & \{R_1, R_1\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_3, R_3\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
X; & \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + [(\alpha_1k_x + \alpha_2k_y)\sigma_+ + h.c.]; \\
U; & \{R_2, R_2\}; \sigma_0(c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_z; \\
S; & \{R_2, R_2\}; \sigma_0(c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_z; \\
T; & \{R_2, R_2\}; \sigma_0(c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{i,1}\sigma_i k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
V; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3(c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+(\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
W; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);
\end{aligned}$$

SG 79

 $\Gamma_q^v; \{C_{4z}^+|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; & \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
N; & \{R_2, R_2\}; c_1\sigma_0 + \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z); \\
X; & \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + [(\alpha_1k_x + \alpha_2k_y)\sigma_+ + h.c.]; \\
Z; & \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
P; & \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3 (c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+ (\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_2\}, \{R_8\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_4\}, \{R_8\}; \sigma_0 (c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3 (c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+ (\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
V; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3 (c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+ (\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_2\}, \{R_8\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
& \{R_4\}, \{R_8\}; \sigma_0 (c_1 + c_2k_z + c_3k^2 + c_4k_z^2) + \sigma_3 (c_5k_z + c_6k^2 + c_7k_z^2) + [\sigma_+ (\alpha_1k_+^2 + \alpha_2k_-^2) + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
W; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y);
\end{aligned}$$

SG 80

 $\Gamma_q^v; \{C_{4z}^+|\frac{3}{4}\frac{1}{4}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; & \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
N; & \{R_2, R_2\}; c_1\sigma_0 + \sum_{i=1}^3 \sigma_i (c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z); \\
X; & \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + [(\alpha_1k_x + \alpha_2k_y)\sigma_+ + h.c.]; \\
Z; & \{R_2, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
P; & \{R_4, R_4\}; \sigma_0 (c_2k^2 + c_3k_z^2 + c_1) + \sum_{i=1}^3 \sigma_i [c_{i,1}k_xk_y + c_{i,2}(k_x^2 - k_y^2) + c_{i,3}k_z];
\end{aligned}$$

$$\begin{aligned}
\Lambda; \quad & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
& \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_2\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
& \{R_4\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
V; \quad & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
& \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_2\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
& \{R_4\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
W; \quad & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y);
\end{aligned}$$

## SG 81

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 $\Gamma_q; \{S_{4z}^+|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned} \Gamma; & \{R_2, R_8\}; c_1\sigma_0 + (\alpha_1\sigma_+k_+ + h.c.); \\ & \{R_4, R_6\}; c_1\sigma_0 + (\alpha_1\sigma_+k_- + h.c.); \\ M; & \{R_2, R_8\}; c_1\sigma_0 + (\alpha_1\sigma_+k_+ + h.c.); \\ & \{R_4, R_6\}; c_1\sigma_0 + (\alpha_1\sigma_+k_- + h.c.); \\ Z; & \{R_2, R_8\}; c_1\sigma_0 + (\alpha_1\sigma_+k_+ + h.c.); \\ & \{R_4, R_6\}; c_1\sigma_0 + (\alpha_1\sigma_+k_- + h.c.); \\ A; & \{R_2, R_8\}; c_1\sigma_0 + (\alpha_1\sigma_+k_+ + h.c.); \\ & \{R_4, R_6\}; c_1\sigma_0 + (\alpha_1\sigma_+k_- + h.c.); \\ R; & \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + [(\alpha_1k_x + \alpha_2k_y)\sigma_+ + h.c.]; \\ X; & \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + [(\alpha_1k_x + \alpha_2k_y)\sigma_+ + h.c.]; \\ \Lambda; & \{R_2, R_4\}; \sigma_0(c_1 + c_2k_z) + (\alpha_1\sigma_+k_+ + h.c.); \\ V; & \{R_2, R_4\}; \sigma_0(c_1 + c_2k_z) + (\alpha_1\sigma_+k_+ + h.c.); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$W; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);$$

## SG 82

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 $\Gamma_q^v; \{S_{4z}^+|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned} \Gamma; & \{R_2, R_8\}; c_1\sigma_0 + (\alpha_1\sigma_+k_+ + h.c.); \\ & \{R_4, R_6\}; c_1\sigma_0 + (\alpha_1\sigma_+k_- + h.c.); \\ N; & \{R_2, R_2\}; c_1\sigma_0 + \sum_{i=1}^3 \sigma_i(c_{i,1}k_x + c_{i,2}k_y + c_{i,3}k_z); \\ X; & \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + [(\alpha_1k_x + \alpha_2k_y)\sigma_+ + h.c.]; \\ Z; & \{R_2, R_8\}; c_1\sigma_0 + (\alpha_1\sigma_+k_+ + h.c.); \\ & \{R_4, R_6\}; c_1\sigma_0 + (\alpha_1\sigma_+k_- + h.c.); \\ \Lambda; & \{R_2, R_4\}; \sigma_0(c_1 + c_2k_z) + (\alpha_1\sigma_+k_+ + h.c.); \\ V; & \{R_2, R_4\}; \sigma_0(c_1 + c_2k_z) + (\alpha_1\sigma_+k_+ + h.c.); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$W; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i(c_{i,1}k_x + c_{i,2}k_y);$$

## SG 83

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 $\Gamma_q; \{C_{4z}^+|000\}, \{I|000\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_2, R_8\}, \{R_4, R_6\}; & \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \Gamma_{2,3}(c_4 k_y - c_5 k_x); \\ V; \{R_2, R_8\}, \{R_4, R_6\}; & \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \Gamma_{2,3}(c_4 k_y - c_5 k_x); \end{aligned}$$

SG 84

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$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{I | 00 \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} Z; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{3,1} k_z + (\alpha_1 \Gamma_{+,1} k_+ + h.c.); \\ A; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{3,1} k_z + (\alpha_1 \Gamma_{+,1} k_+ + h.c.); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_2, R_8\}, \{R_4, R_6\}; & \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \Gamma_{2,3}(c_4 k_y - c_5 k_x); \\ V; \{R_2, R_8\}, \{R_4, R_6\}; & \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \Gamma_{2,3}(c_4 k_y - c_5 k_x); \end{aligned}$$

SG 85

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$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} M; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{3,1} k_z + (\alpha_1 \Gamma_{+,1} k_+ + h.c.); \\ A; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{3,1} k_z + (\alpha_1 \Gamma_{+,1} k_+ + h.c.); \\ R; \{R_9, R_9\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1} k_x + c_{i,2} k_y); \\ X; \{R_9, R_9\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1} k_x + c_{i,2} k_y); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_2, R_8\}, \{R_4, R_6\}; & \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \Gamma_{2,3}(c_4 k_y - c_5 k_x); \\ V; \{R_{10}, R_{12}\}, \{R_{14}, R_{16}\}; & \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{2,1}(c_4 k_x - c_5 k_y) - \Gamma_{2,2}(c_4 k_y + c_5 k_x); \\ W; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \sum_{i=1}^3 \Gamma_{2,i}(c_{i,1} k_x + c_{i,2} k_y); \end{aligned}$$

SG 86

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$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} M; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{3,1} k_z + (\alpha_1 \Gamma_{+,1} k_+ + h.c.); \\ Z; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{3,1} k_z + (\alpha_1 \Gamma_{+,1} k_+ + h.c.); \\ R; \{R_9, R_9\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1} k_x + c_{i,2} k_y); \\ X; \{R_9, R_9\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1} k_x + c_{i,2} k_y); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}\Lambda; \{R_2, R_8\}, \{R_4, R_6\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \Gamma_{2,3}(c_4 k_y - c_5 k_x); \\ V; \{R_{10}, R_{12}\}, \{R_{14}, R_{16}\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{2,1}(c_4 k_x - c_5 k_y) - \Gamma_{2,2}(c_4 k_y + c_5 k_x); \\ W; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \sum_{i=1}^3 \Gamma_{2,i}(c_{i,1} k_x + c_{i,2} k_y);\end{aligned}$$

SG 87

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$$\Gamma_q^v; \{C_{4z}^+ | 000\}, \{I | 000\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}\Lambda; \{R_2, R_8\}, \{R_4, R_6\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \Gamma_{2,3}(c_4 k_y - c_5 k_x); \\ V; \{R_2, R_8\}, \{R_4, R_6\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \Gamma_{2,3}(c_4 k_y - c_5 k_x);\end{aligned}$$

SG 88

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$$\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{I | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$$

$$\begin{aligned}X; \{R_9, R_9\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_z + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1} k_x + c_{i,2} k_y); \\ Z; \{R_{19}, R_{20}\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{3,1} k_z + (\alpha_1 \Gamma_{+,1} k_+ + h.c.); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}\Lambda; \{R_2, R_8\}, \{R_4, R_6\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \Gamma_{2,3}(c_4 k_y - c_5 k_x); \\ V; \{R_{10}, R_{12}\}, \{R_{14}, R_{16}\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{2,1}(c_4 k_x - c_5 k_y) - \Gamma_{2,2}(c_4 k_y + c_5 k_x); \\ W; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0}(c_4 k_x + c_5 k_y) + \sum_{i=1}^3 \Gamma_{2,i}(c_{i,1} k_x + c_{i,2} k_y);\end{aligned}$$

SG 89

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$$\Gamma_q; \{C_{4z}^+ | 000\}, \{C_{2x} | 000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$$

$$\begin{aligned}\Gamma; & \quad R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ & \quad R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ M; & \quad R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ & \quad R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ Z; & \quad R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ & \quad R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ A; & \quad R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ & \quad R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ R; & \quad R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\ X; & \quad R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0;\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_2\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \{R_4\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
V; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_2\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \{R_4\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
T; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
W; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y;
\end{aligned}$$

SG 90

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 $\Gamma_q; \{C_{4z}^+ | 000\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
M; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z + [\alpha_1 (k_x \Gamma_{+,0} + i k_y \Gamma_{+,1}) + h.c.]; \\
Z; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
A; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z + [\alpha_1 (k_x \Gamma_{+,0} + i k_y \Gamma_{+,1}) + h.c.]; \\
R; \{R_5, R_6\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
& \{R_7, R_8\}; (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
X; \{R_5, R_6\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
& \{R_7, R_8\}; (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
V; \{R_2, R_6\}; & \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) + (\alpha_1 \sigma_+ k_x k_y + h.c.); \\
& \{R_4, R_8\}; \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) + (\alpha_1 \sigma_+ k_x k_y + h.c.); \\
Y; \{R_5, R_7\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y; \\
T; \{R_5, R_7\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y; \\
W; \{R_2, R_4\}; & \sigma_0 (c_3 k_z + c_1) + (c_2 \sigma_1 - c_4 \sigma_2) k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
U; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Lambda; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \quad \{R_2\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \quad \{R_2\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
& \quad \{R_4\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \quad \{R_4\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \quad \{R_6\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
V; \{R_2, R_6\}, \{R_4, R_8\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \left\{ e^{i\pi/4} [(c_4 \Gamma_{+,0} + i c_5 \Gamma_{+,3}) k_- + i k_+ (c_6 \Gamma_{+,1} + c_7 \Gamma_{+,2})] + h.c. \right\}; \\
\Sigma; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
S; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x);
\end{aligned}$$

SG 91

 $\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{4}\}, \{C_{2x} | 000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
M; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
Z; \{R_8, R_{10}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\{R_9, R_{11}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
R_{14}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
A; \{R_8, R_{10}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\{R_9, R_{11}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
R_{14}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
R; \{R_5, R_6\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\{R_7, R_8\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
X; R_5; & c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
U; \{R_5, R_7\}; & \sigma_0 (c_2 k_y + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
S; \{R_{12}, R_{16}\}; & \sigma_0 [c_1 + c_2 (k_x + k_y)] + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
T; \{R_2, R_4\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_4\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
V; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_4\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y; \\
W; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y;
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{4}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
\Gamma; \quad R_6; & \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
& \quad R_7; \quad c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
M; \quad \{R_6, R_7\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z + [\alpha_1 (k_x \Gamma_{+,0} + i k_y \Gamma_{+,1}) + h.c.]; \\
Z; \quad \{R_8, R_{10}\}; & \quad (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
& \quad \{R_9, R_{11}\}; & \quad (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
& \quad R_{14}; & \quad c_2 \sigma_3 k_z + c_1 \sigma_0; \\
A; \quad \{R_8, R_{11}\}; & \quad \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2) + (\alpha_1 \sigma_+ k_x k_y k_z + h.c.); \\
& \quad \{R_9, R_{10}\}; & \quad \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2) + (\alpha_1 \sigma_+ k_x k_y k_z + h.c.); \\
& \quad \{R_{12}, R_{12}\}; & \quad \Gamma_{0,0} (c_1 + c_2 k^2 + c_3 k_z^2) + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,2} k_z + c_{i,2} \Gamma_{i,3} k_x k_y) + c_4 \Gamma_{0,1} (k_x^2 - k_y^2); \\
R; \quad \{R_9, R_9\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{0,3} k_x + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,1} k_y + c_{i,2} \Gamma_{i,2} k_z); \\
X; \quad \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
& \quad \{R_7, R_8\}; & \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
U; \quad \{R_5, R_7\}; & \quad \sigma_0 (c_2 k_y + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
V; \quad \{R_2, R_6\}; & \quad \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) + (\alpha_1 \sigma_+ k_x k_y + h.c.); \\
& \quad \{R_4, R_8\}; & \quad \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) + (\alpha_1 \sigma_+ k_x k_y + h.c.); \\
S; \quad \{R_{12}, R_{16}\}; & \quad \sigma_0 [c_2 (k_x + k_y) + c_1] + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
Y; \quad \{R_5, R_7\}; & \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y; \\
T; \quad \{R_5, R_5\}; & \quad \sigma_0 \left( c_1 + c_2 k_x + \sum_{i=x,y,z} c_i k_i^2 \right) + [(\alpha_1 \sigma_+ + c_3 \sigma_3) k_y k_z + h.c.]; \\
& \quad \{R_7, R_7\}; & \quad \sigma_0 \left( c_1 + c_2 k_x + \sum_{i=x,y,z} c_i k_i^2 \right) + [(\alpha_1 \sigma_+ + c_3 \sigma_3) k_y k_z + h.c.]; \\
W; \quad \{R_2, R_4\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + \sigma_0 (c_3 k_z + c_1);
\end{aligned}$$

#### Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Lambda; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \quad \{R_2\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \quad \{R_2\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
& \quad \{R_4\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \quad \{R_4\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \quad \{R_6\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
V; \quad \{R_2, R_6\}, \{R_4, R_8\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \left\{ e^{i\pi/4} [(c_4 \Gamma_{+,0} + i c_5 \Gamma_{+,3}) k_- + i k_+ (c_6 \Gamma_{+,1} + c_7 \Gamma_{+,2})] + h.c. \right\}; \\
\Sigma; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
T; \quad \{R_5, R_5\}, \{R_7, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + c_4 \Gamma_{1,0} k_z + c_5 \Gamma_{2,0} k_y + \sum_{i=1}^3 (c_{i,1} \Gamma_{1,i} k_y + c_{i,2} \Gamma_{2,i} k_z);
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{C_{2x}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
&\Gamma; R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
&\quad R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
&M; R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
&\quad R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
&Z; R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
&\quad R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
&A; R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
&\quad R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
&R; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
&X; R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
&U; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
&\Lambda; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left(e^{i\pi/4} c_4 \sigma_+ k_- + h.c.\right); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3(c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+(\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left(e^{i\pi/4} c_4 \sigma_- k_- + h.c.\right); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left(e^{i\pi/4} c_4 \sigma_+ k_- + h.c.\right); \\
&\quad \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3(c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+(\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left(e^{i\pi/4} c_4 \sigma_+ k_- + h.c.\right); \\
&V; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left(e^{i\pi/4} c_4 \sigma_+ k_- + h.c.\right); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3(c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+(\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left(e^{i\pi/4} c_4 \sigma_- k_- + h.c.\right); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left(e^{i\pi/4} c_4 \sigma_+ k_- + h.c.\right); \\
&\quad \{R_4\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3(c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+(\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left(e^{i\pi/4} c_4 \sigma_+ k_- + h.c.\right); \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3(k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2(k_y - k_x); \\
&S; \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3(k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2(k_y - k_x); \\
&Y; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
&T; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
&W; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y;
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
\Gamma; \quad & R_6; \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
& R_7; \quad c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
M; \quad & \{R_6, R_7\}; \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z + [\alpha_1 (k_x \Gamma_{+,0} + i k_y \Gamma_{+,1}) + h.c.]; \\
Z; \quad & R_6; \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
& R_7; \quad c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
A; \quad & \{R_6, R_7\}; \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z + [\alpha_1 (k_x \Gamma_{+,0} + i k_y \Gamma_{+,1}) + h.c.]; \\
R; \quad & \{R_5, R_6\}; \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
& \{R_7, R_8\}; \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
X; \quad & \{R_5, R_6\}; \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
& \{R_7, R_8\}; \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
V; \quad & \{R_2, R_6\}; \quad \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) + (\alpha_1 \sigma_+ k_x k_y + h.c.); \\
& \{R_4, R_8\}; \quad \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) + (\alpha_1 \sigma_+ k_x k_y + h.c.); \\
Y; \quad & \{R_5, R_7\}; \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y; \\
T; \quad & \{R_5, R_7\}; \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y; \\
W; \quad & \{R_2, R_4\}; \quad \sigma_0 (c_3 k_z + c_1) + (c_2 \sigma_1 - c_4 \sigma_2) k_y;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
U; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Lambda; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \{R_2\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_2\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
& \{R_4\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \{R_4\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \{R_6\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
V; \quad & \{R_2, R_6\}, \{R_4, R_8\}; \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \left\{ e^{i\pi/4} [(c_4 \Gamma_{+,0} + i c_5 \Gamma_{+,3}) k_- + i k_+ (c_6 \Gamma_{+,1} + c_7 \Gamma_{+,2})] + h.c. \right\}; \\
\Sigma; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
S; \quad & \{R_5\}, \{R_7\}; \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x);
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | 00 \frac{3}{4}\}, \{C_{2x} | 000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
M; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
Z; \{R_8, R_{10}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\{R_9, R_{11}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
R_{14}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
A; \{R_8, R_{10}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\{R_9, R_{11}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
R_{14}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
R; \{R_5, R_6\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\{R_7, R_8\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
X; R_5; & c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
U; \{R_5, R_7\}; & \sigma_0 (c_2 k_y + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
S; \{R_{10}, R_{14}\}; & \sigma_0 [c_2 (k_x + k_y) + c_1] + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
T; \{R_2, R_4\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_4\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
V; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_4\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
W; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y;
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | 00 \frac{3}{4}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
\Gamma; \quad R_6; & \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
R_7; & \quad c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
M; \quad \{R_6, R_7\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z + [\alpha_1 (k_x \Gamma_{+,0} + i k_y \Gamma_{+,1}) + h.c.]; \\
Z; \quad \{R_8, R_{10}\}; & \quad (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
& \quad \{R_9, R_{11}\}; & \quad (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
R_{14}; & \quad c_2 \sigma_3 k_z + c_1 \sigma_0; \\
A; \quad \{R_8, R_{11}\}; & \quad \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2) + (\alpha_1 \sigma_+ k_x k_y k_z + h.c.); \\
& \quad \{R_9, R_{10}\}; & \quad \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2) + (\alpha_1 \sigma_+ k_x k_y k_z + h.c.); \\
& \quad \{R_{12}, R_{12}\}; & \quad \Gamma_{0,0} (c_1 + c_2 k^2 + c_3 k_z^2) + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,2} k_z + c_{i,2} \Gamma_{i,3} k_x k_y) + c_4 \Gamma_{0,1} (k_x^2 - k_y^2); \\
R; \quad \{R_9, R_9\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{0,3} k_x + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,1} k_y + c_{i,2} \Gamma_{i,2} k_z); \\
X; \quad \{R_5, R_6\}; & \quad (c_2 \sigma_1 + c_3 \sigma_2) k_y + c_1 \sigma_0; \\
& \quad \{R_7, R_8\}; & \quad (c_2 \sigma_1 + c_3 \sigma_2) k_y + c_1 \sigma_0; \\
U; \quad \{R_5, R_7\}; & \quad \sigma_0 (c_2 k_y + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
V; \quad \{R_2, R_6\}; & \quad \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) + (\alpha_1 \sigma_+ k_x k_y + h.c.); \\
& \quad \{R_4, R_8\}; & \quad \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) + (\alpha_1 \sigma_+ k_x k_y + h.c.); \\
S; \quad \{R_{12}, R_{16}\}; & \quad \sigma_0 [c_2 (k_x + k_y) + c_1] + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
Y; \quad \{R_5, R_7\}; & \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y; \\
T; \quad \{R_5, R_5\}; & \quad \sigma_0 \left( c_1 + c_2 k_x + \sum_{i=x,y,z} c_i k_i^2 \right) + [(\alpha_1 \sigma_+ + c_5 \sigma_3) k_y k_z + h.c.]; \\
& \quad \{R_7, R_7\}; & \quad \sigma_0 \left( c_1 + c_2 k_x + \sum_{i=x,y,z} c_i k_i^2 \right) + [(\alpha_1 \sigma_+ + c_5 \sigma_3) k_y k_z + h.c.]; \\
W; \quad \{R_2, R_4\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + \sigma_0 (c_3 k_z + c_1);
\end{aligned}$$

#### Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Lambda; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \quad \{R_2\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \quad \{R_2\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
& \quad \{R_4\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
& \quad \{R_4\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
& \quad \{R_6\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
V; \quad \{R_2, R_6\}, \{R_4, R_8\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \left\{ e^{i\pi/4} [(c_4 \Gamma_{+,0} + i c_5 \Gamma_{+,3}) k_- + i k_+ (c_6 \Gamma_{+,1} + c_7 \Gamma_{+,2})] + h.c. \right\}; \\
\Sigma; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
T; \quad \{R_5, R_5\}, \{R_7, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + c_4 \Gamma_{1,0} k_z + c_5 \Gamma_{2,0} k_y + \sum_{i=1}^3 (c_{i,1} \Gamma_{1,i} k_y + c_{i,2} \Gamma_{2,i} k_z);
\end{aligned}$$



SG 97

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
N; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z) + c_2 \sigma_3 k_y + c_1 \sigma_0; \\
X; R_5; & c_3 \sigma_1 (k_x - k_y) + c_2 \sigma_3 (k_x + k_y) - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
Z; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
P; R_5; & c_2 (\sigma_3 k_x + \sigma_1 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_4\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
V; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_4\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
W; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 (k_x + k_y) + c_5 \sigma_2 (k_y - k_x); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
Q; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 c_3 (k_x - k_y) + c_4 \sigma_1 (k_x + k_y) + c_5 \sigma_2 k_z;
\end{aligned}$$

SG 98

 $\Gamma_q^v; \{C_{4z}^+|\frac{3}{4}\frac{1}{4}\frac{1}{2}\}, \{C_{2x}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
N; \{R_2, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z) + c_2 \sigma_3 k_y + c_1 \sigma_0; \\
X; R_5; & c_3 \sigma_1 (k_x - k_y) + c_2 \sigma_3 (k_x + k_y) - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
Z; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
P; \{R_1, R_4\}; & \sum_{i=1}^2 \sigma_i (c_{i,1} k_x k_y + c_{i,2} k_z) + c_4 \sigma_3 (k_x^2 - k_y^2) + \sigma_0 (c_1 + c_2 k^2 + c_3 k_z^2);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_4\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
V; \{R_{10}\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_{10}\}, \{R_{14}\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_{10}\}, \{R_{16}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_- k_- + h.c. \right); \\
\{R_{12}\}, \{R_{14}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
\{R_{12}\}, \{R_{16}\}; & \sigma_0 (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) + \sigma_3 (c_5 k_z + c_6 k^2 + c_7 k_z^2) + [\sigma_+ (\alpha_1 k_+^2 + \alpha_2 k_-^2) + h.c.]; \\
\{R_{14}\}, \{R_{16}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \left( e^{i\pi/4} c_4 \sigma_+ k_- + h.c. \right); \\
W; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 (k_x + k_y) + c_5 \sigma_2 (k_y - k_x); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
Q; \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
U; \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 c_3 (k_x - k_y) + c_4 \sigma_1 (k_x + k_y) + c_5 \sigma_2 k_z;
\end{aligned}$$

SG 99

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 $\Gamma_q; \{C_{4z}^+ | 000\}, \{\sigma_y | 000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; & R_6; c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; & R_6; c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
Z; & R_6; c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
A; & R_6; c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
R; & R_5; c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
X; & R_5; c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
\Lambda; & R_6; \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
& R_7; \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
V; & R_6; \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
& R_7; \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
W; & R_5; \sigma_0 (c_4 k_z + c_1) + c_2 \sigma_1 k_x + c_3 \sigma_3 k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
V; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
T; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y;
\end{aligned}$$

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SG 100

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 $\Gamma_q; \{C_{4z}^+ | 000\}, \{\sigma_y | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + c_3 \Gamma_{3,0} k_z + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.]; \\
Z; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
A; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + c_3 \Gamma_{3,0} k_z + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.]; \\
R; \{R_5, R_6\}; & (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
X; \{R_5, R_6\}; & (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
\Lambda; R_6; & \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
& R_7; \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
V; R_6; & \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_2 k_x + \sigma_3 k_y); \\
& R_7; \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_2 k_x - \sigma_3 k_y); \\
Y; \{R_5, R_7\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z; \\
T; \{R_5, R_7\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z;
\end{aligned}$$

$$\Delta; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x;$$

$$U; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x;$$

$$\Lambda; \{R_6\}, \{R_7\}; \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.];$$

$$V; \{R_6\}, \{R_7\}; \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,2} + c_5 \Gamma_{3,2}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.];$$

$$\Sigma; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x);$$

$$S; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x);$$

$$W; \{R_5\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x;$$

$$\{R_5\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y;$$

$$\{R_5\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z;$$

$$\{R_6\}, \{R_7\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z;$$

$$\{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y;$$

$$\{R_7\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x;$$

SG 101

 $\Gamma_q; \{C_{4z}^+ | 00\frac{1}{2}\}, \{\sigma_y | 00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
Z; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + c_3 \Gamma_{3,0} k_z + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.]; \\
A; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + c_3 \Gamma_{3,0} k_z + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.]; \\
R; \{R_9, R_9\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,2} k_x + c_{i,2} \Gamma_{i,1} k_y + c_{i,3} \Gamma_{i,0} k_z); \\
X; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
U; \{R_2, R_4\}; & \sigma_0 (c_3 k_y + c_1) + (c_2 \sigma_1 - c_5 \sigma_2) k_x + c_4 \sigma_3 k_z; \\
\Lambda; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
T; \{R_2, R_4\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z; \\
W; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + \sigma_0 (c_4 k_z + c_1);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
V; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y;
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{\sigma_y | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
\Gamma; \quad & R_6; \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; \quad c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; \quad & \{R_6, R_7\}; \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + c_3 \Gamma_{3,0} k_z + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.]; \\
Z; \quad & \{R_6, R_7\}; \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + c_3 \Gamma_{3,0} k_z + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.]; \\
A; \quad & R_6; \quad c_2 (\sigma_3 k_x - \sigma_1 k_y) + c_1 \sigma_0; \\
& R_7; \quad c_2 (\sigma_3 k_x + \sigma_1 k_y) + c_1 \sigma_0; \\
R; \quad & \{R_5, R_6\}; \quad (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; \quad (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
X; \quad & \{R_5, R_6\}; \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
U; \quad & \{R_2, R_4\}; \quad \sigma_0 (c_3 k_y + c_1) + (c_2 \sigma_1 - c_5 \sigma_2) k_x + c_4 \sigma_3 k_z; \\
\Lambda; \quad & R_6; \quad \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
& R_7; \quad \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
V; \quad & R_6; \quad \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_2 k_x + \sigma_3 k_y); \\
& R_7; \quad \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_2 k_x - \sigma_3 k_y); \\
Y; \quad & \{R_5, R_7\}; \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
\Lambda; \quad & \{R_6\}, \{R_7\}; \quad \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
V; \quad & \{R_6\}, \{R_7\}; \quad \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,2} + c_5 \Gamma_{3,2}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.]; \\
\Sigma; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
S; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
T; \quad & \{R_5\}, \{R_7\}; \quad \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
W; \quad & \{R_5\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
& \{R_5\}, \{R_7\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_5\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_6\}, \{R_7\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_6\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_7\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x;
\end{aligned}$$

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 $\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
Z; \{R_6, R_6\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 \{c_{i,1} [\Gamma_{i,1} (k_x - k_y) + \Gamma_{i,3} (k_x + k_y)] + c_{i,2} \Gamma_{i,0} k_z\}; \\
\{R_7, R_7\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 \{c_{i,1} [\Gamma_{i,1} (k_x - k_y) - \Gamma_{i,3} (k_x + k_y)] + c_{i,2} \Gamma_{i,0} k_z\}; \\
A; \{R_6, R_6\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 \{c_{i,1} [\Gamma_{i,1} (k_x - k_y) + \Gamma_{i,3} (k_x + k_y)] + c_{i,2} \Gamma_{i,0} k_z\}; \\
\{R_7, R_7\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 \{c_{i,1} [\Gamma_{i,1} (k_x - k_y) - \Gamma_{i,3} (k_x + k_y)] + c_{i,2} \Gamma_{i,0} k_z\}; \\
R; \{R_9, R_9\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,2} k_x + c_{i,2} \Gamma_{i,1} k_y + c_{i,3} \Gamma_{i,0} k_z); \\
X; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
U; \{R_2, R_4\}; & \sigma_0 (c_3 k_y + c_1) + (c_2 \sigma_1 - c_5 \sigma_2) k_x + c_4 \sigma_3 k_z; \\
\Lambda; R_6; & \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
R_7; & \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
V; R_6; & \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
R_7; & \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
S; \{R_2, R_4\}; & [c_1 + c_2 (k_x + k_y)] \sigma_0 + (c_3 \sigma_1 - c_5 \sigma_2) (k_x - k_y) + c_4 \sigma_3 k_z; \\
T; \{R_2, R_4\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z; \\
W; R_5; & \sigma_0 (c_2 k_z + c_1) + c_3 \sigma_1 k_x + c_4 \sigma_3 k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
V; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y;
\end{aligned}$$

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 $\Gamma_q; \{C_{4z}^+|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \quad & R_6; \quad c_2(\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; \quad c_2(\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; \quad & \{R_6, R_7\}; c_1 \Gamma_{0,0} + c_2(\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + c_3 \Gamma_{3,0} k_z + [\alpha_1(k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.]; \\
Z; \quad & \{R_6, R_6\}; c_1 \Gamma_{0,0} + \sum_{i=1}^3 \{c_{i,1}[\Gamma_{i,1}(k_x - k_y) + \Gamma_{i,3}(k_x + k_y)] + c_{i,2} \Gamma_{i,0} k_z\}; \\
& \{R_7, R_7\}; c_1 \Gamma_{0,0} + \sum_{i=1}^3 \{c_{i,1}[\Gamma_{i,1}(k_x - k_y) - \Gamma_{i,3}(k_x + k_y)] + c_{i,2} \Gamma_{i,0} k_z\}; \\
A; \quad & \{R_6, R_7\}; c_1 \Gamma_{0,0} + c_2[\Gamma_{0,2}(k_x - k_y) + \Gamma_{3,3}(k_x + k_y)] + c_3 \Gamma_{3,0} k_z + \{\alpha_1[(k_x + k_y) \Gamma_{+,0} - i(k_x - k_y) \Gamma_{+,1}] + h.c.\}; \\
R; \quad & \{R_5, R_6\}; (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
X; \quad & \{R_5, R_6\}; (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
U; \quad & \{R_2, R_4\}; \sigma_0(c_3 k_y + c_1) + (c_2 \sigma_1 - c_5 \sigma_2) k_x + c_4 \sigma_3 k_z; \\
\Lambda; \quad & R_6; \quad \sigma_0(c_3 k_z + c_1) + c_2(\sigma_1 k_x + \sigma_3 k_y); \\
& R_7; \quad \sigma_0(c_3 k_z + c_1) + c_2(\sigma_1 k_x - \sigma_3 k_y); \\
V; \quad & R_6; \quad \sigma_0(c_3 k_z + c_1) - c_2(\sigma_2 k_x + \sigma_3 k_y); \\
& R_7; \quad \sigma_0(c_3 k_z + c_1) + c_2(\sigma_2 k_x - \sigma_3 k_y); \\
S; \quad & \{R_2, R_4\}; [c_1 + c_2(k_x + k_y)] \sigma_0 + (c_3 \sigma_1 - c_5 \sigma_2)(k_x - k_y) + c_4 \sigma_3 k_z; \\
Y; \quad & \{R_5, R_7\}; \sigma_0(c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
\Lambda; \quad & \{R_6\}, \{R_7\}; \Gamma_{0,0}(c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1(k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
V; \quad & \{R_6\}, \{R_7\}; \Gamma_{0,0}(c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,2} + c_5 \Gamma_{3,2}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1(k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.]; \\
\Sigma; \quad & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3(k_x + k_y) + c_4 \sigma_2(k_y - k_x); \\
T; \quad & \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
W; \quad & \{R_5\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
& \{R_5\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_5\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_6\}, \{R_7\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_7\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x;
\end{aligned}$$



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 $\Gamma_q; \{C_{4z}^+ | 00\frac{1}{2}\}, \{\sigma_y | 000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
Z; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,2} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + c_3 \Gamma_{3,0} k_z + \{\alpha_1 [(k_x + k_y) \Gamma_{+,0} - i (k_x - k_y) \Gamma_{+,1}] + h.c.\}; \\
A; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,2} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + c_3 \Gamma_{3,0} k_z + \{\alpha_1 [(k_x + k_y) \Gamma_{+,0} - i (k_x - k_y) \Gamma_{+,1}] + h.c.\}; \\
R; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
X; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
\Lambda; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
S; \{R_2, R_4\}; & [c_1 + c_2 (k_x + k_y)] \sigma_0 + (c_3 \sigma_1 - c_5 \sigma_2) (k_x - k_y) + c_4 \sigma_3 k_z; \\
W; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + \sigma_0 (c_4 k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
V; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
T; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y;
\end{aligned}$$

$\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{\sigma_y | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \quad & R_6; \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; \quad c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; \quad & \{R_6, R_7\}; \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + c_3 \Gamma_{3,0} k_z + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.]; \\
Z; \quad & \{R_6, R_7\}; \quad c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,2} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + c_3 \Gamma_{3,0} k_z + \{\alpha_1 [(k_x + k_y) \Gamma_{+,0} - i (k_x - k_y) \Gamma_{+,1}] + h.c.\}; \\
A; \quad & \{R_6, R_6\}; \quad c_1 \Gamma_{0,0} + \sum_{i=1}^3 \{c_{i,1} [\Gamma_{i,1} (k_x - k_y) + \Gamma_{i,3} (k_x + k_y)] + c_{i,2} \Gamma_{i,0} k_z\}; \\
& \{R_7, R_7\}; \quad c_1 \Gamma_{0,0} + \sum_{i=1}^3 \{c_{i,1} [\Gamma_{i,1} (k_x - k_y) - \Gamma_{i,3} (k_x + k_y)] + c_{i,2} \Gamma_{i,0} k_z\}; \\
R; \quad & \{R_5, R_6\}; \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
X; \quad & \{R_5, R_6\}; \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
\Lambda; \quad & R_6; \quad \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x + \sigma_3 k_y); \\
& R_7; \quad \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_1 k_x - \sigma_3 k_y); \\
V; \quad & R_6; \quad \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_2 k_x + \sigma_3 k_y); \\
& R_7; \quad \sigma_0 (c_3 k_z + c_1) + c_2 (\sigma_2 k_x - \sigma_3 k_y); \\
S; \quad & \{R_2, R_4\}; \quad \sigma_0 [c_1 + c_2 (k_x + k_y)] + (c_3 \sigma_1 - c_5 \sigma_2) (k_x - k_y) + c_4 \sigma_3 k_z; \\
Y; \quad & \{R_5, R_7\}; \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z; \\
T; \quad & \{R_5, R_7\}; \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
U; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x; \\
\Lambda; \quad & \{R_6\}, \{R_7\}; \quad \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
V; \quad & \{R_6\}, \{R_7\}; \quad \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,2} + c_5 \Gamma_{3,2}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + h.c.]; \\
\Sigma; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
W; \quad & \{R_5\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
& \{R_5\}, \{R_7\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_5\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_6\}, \{R_7\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_6\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \{R_7\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x;
\end{aligned}$$

SG 107

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{\sigma_y|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
N; \{R_2, R_4\}; & \sigma_3 (c_2 k_x + c_4 k_z) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_1 \sigma_0; \\
X; R_5; & c_3 \sigma_1 (k_x + k_y) + c_2 \sigma_3 (k_x - k_y) + c_1 \sigma_0; \\
Z; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
P; R_5; & c_2 [\sigma_1 (k_x + k_y) + \sigma_3 (k_x - k_y)] + c_1 \sigma_0; \\
\Lambda; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
W; R_5; & c_3 \sigma_1 (k_x + k_y) + c_2 \sigma_3 (k_x - k_y) + \sigma_0 (c_4 k_z + c_1);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
V; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 c_3 (k_x - k_y) + c_4 \sigma_1 (k_x + k_y);
\end{aligned}$$

SG 108

 $\Gamma_q^v; \{C_{4z}^+|000\}, \{\sigma_y|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
N; \{R_5, R_7\}; & c_1 \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z); \\
\{R_7, R_7\}; & c_1 \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z); \\
X; R_5; & c_3 \sigma_1 (k_x + k_y) + c_2 \sigma_3 (k_x - k_y) + c_1 \sigma_0; \\
Z; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
P; \{R_5, R_7\}; & c_1 \Gamma_{0,0} + (c_2 \Gamma_{0,3} + c_3 \Gamma_{3,3}) (k_x - k_y) - (c_2 \Gamma_{0,1} - c_3 \Gamma_{3,1}) (k_x + k_y) \\
& + c_4 \Gamma_{3,0} k_z + [\alpha_1 \Gamma_{+,1} (k_x + k_y) + \alpha_1 \Gamma_{+,3} (k_x - k_y) + \alpha_2 k_z \Gamma_{+,0} + h.c.]; \\
\Lambda; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
W; R_5; & c_3 \sigma_1 (k_x + k_y) + c_2 \sigma_3 (k_x - k_y) + \sigma_0 (c_4 k_z + c_1); \\
Q; \{R_2, R_2\}; & \sigma_0 (c_2 k_y + c_1) + \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
V; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 c_3 (k_x - k_y) + c_4 \sigma_1 (k_x + k_y);
\end{aligned}$$

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SG 109

 $\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{\sigma_y | 000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

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$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
N; \{R_2, R_4\}; & \sigma_3 (c_2 k_x + c_4 k_z) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_1 \sigma_0; \\
X; \{R_5, R_6\}; & (c_2 \sigma_1 - c_4 \sigma_2) (k_x + k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \{R_7, R_8\}; & (c_2 \sigma_1 - c_4 \sigma_2) (k_x + k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
Z; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,2} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + c_3 \Gamma_{3,0} k_z + \{\alpha_1 [(k_x + k_y) \Gamma_{+,0} - i (k_x - k_y) \Gamma_{+,1}] + h.c.\}; \\
P; \{R_{17}, R_{18}\}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
\Lambda; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
& R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; R_6; & c_2 [(\sigma_2 + \sigma_3) k_x + (\sigma_3 - \sigma_2) k_y] + \sigma_0 (c_3 k_z + c_1); \\
& R_7; & c_2 [(\sigma_3 - \sigma_2) k_x + (\sigma_2 + \sigma_3) k_y] + \sigma_0 (c_3 k_z + c_1); \\
U; \{R_2, R_4\}; & [c_1 + c_2 (k_x + k_y)] \sigma_0 + (c_3 \sigma_1 - c_5 \sigma_2) (k_x - k_y) + c_4 \sigma_3 k_z; \\
Y; \{R_5, R_7\}; & [c_1 + c_2 (k_x - k_y)] \sigma_0 + (c_3 \sigma_1 - c_5 \sigma_2) (k_x + k_y) + c_4 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
V; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,2} + c_5 \Gamma_{3,2}) (k_x - k_y) + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) (k_x + k_y) + \\
& [\alpha_1 \Gamma_{+,0} (k_x + k_y) - i \alpha_1 \Gamma_{+,1} (k_x - k_y) + h.c.]; \\
W; \{R_5\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x - k_y); \\
& \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x + k_y); \\
& \{R_5\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_6\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x + k_y); \\
& \{R_7\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x - k_y); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x);
\end{aligned}$$

$\Gamma_q^v; \{C_{4z}^+ | \frac{3}{4} \frac{1}{4} \frac{1}{2}\}, \{\sigma_y | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
N; \{R_5, R_5\}; & c_1 \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z); \\
\{R_7, R_7\}; & c_1 \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z); \\
X; \{R_5, R_6\}; & (c_2 \sigma_1 - c_4 \sigma_2) (k_x + k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
\{R_7, R_8\}; & (c_2 \sigma_1 - c_4 \sigma_2) (k_x + k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
Z; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,2} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + c_3 \Gamma_{3,0} k_z + \{\alpha_1 [(k_x + k_y) \Gamma_{+,0} - i (k_x - k_y) \Gamma_{+,1}] + h.c.\}; \\
P; \{R_{13}, R_{14}\}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
\{R_{17}, R_{17}\}; & (c_3 \sigma_1 - c_4 \sigma_2 + c_2 \sigma_3) k_z + c_1 \sigma_0; \\
\{R_{18}, R_{18}\}; & (c_3 \sigma_1 - c_4 \sigma_2 + c_2 \sigma_3) k_z + c_1 \sigma_0; \\
\Lambda; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; R_6; & c_2 [(\sigma_2 + \sigma_3) k_x + (\sigma_3 - \sigma_2) k_y] + \sigma_0 (c_3 k_z + c_1); \\
R_7; & c_2 [(\sigma_3 - \sigma_2) k_x + (\sigma_2 + \sigma_3) k_y] + \sigma_0 (c_3 k_z + c_1); \\
Q; \{R_2, R_2\}; & (c_1 + c_2 k_y) \sigma_0 + \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z); \\
U; \{R_2, R_4\}; & [c_1 + c_2 (k_x + k_y)] \sigma_0 + (c_3 \sigma_1 - c_5 \sigma_2) (k_x - k_y) + c_4 \sigma_3 k_z; \\
Y; \{R_5, R_7\}; & [c_1 + c_2 (k_x - k_y)] \sigma_0 + (c_3 \sigma_1 - c_5 \sigma_2) (k_x + k_y) + c_4 \sigma_3 k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,1} + c_5 \Gamma_{3,1}) k_x + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) k_y + [\alpha_1 (k_x \Gamma_{+,0} - i k_y \Gamma_{+,2}) + h.c.]; \\
V; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_2 k_z + c_1) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{0,2} + c_5 \Gamma_{3,2}) (k_x - k_y) + (c_4 \Gamma_{3,3} + c_5 \Gamma_{0,3}) (k_x + k_y) + \\
& [\alpha_1 \Gamma_{+,0} (k_x + k_y) - i \alpha_1 \Gamma_{+,1} (k_x - k_y) + h.c.]; \\
W; \{R_5\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x - k_y); \\
\{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x + k_y); \\
\{R_5\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
\{R_6\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x + k_y); \\
\{R_7\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x - k_y); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x);
\end{aligned}$$

## SG 111

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; & R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; & R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
Z; & R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
A; & R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
R; & R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
X; & R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
\Lambda; & R_5; c_2[(\sigma_3 - \sigma_1)k_x - (\sigma_1 + \sigma_3)k_y] + \sigma_0(c_3 k_z + c_1); \\
V; & R_5; c_2[(\sigma_3 - \sigma_1)k_x - (\sigma_1 + \sigma_3)k_y] + \sigma_0(c_3 k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
U; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Sigma; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3(k_x + k_y) + c_4 \sigma_2(k_y - k_x); \\
S; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3(k_x + k_y) + c_4 \sigma_2(k_y - k_x); \\
Y; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
T; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
W; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y;
\end{aligned}$$

## SG 112

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; & R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; & R_6; c_2(\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2(\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
Z; & \{R_6, R_7\}; c_1 \Gamma_{0,0} + c_2[\Gamma_{0,2}(k_x - k_y) + \Gamma_{3,3}(k_x + k_y)] + [\alpha_1 \Gamma_{+,0}(k_x + k_y) - i\alpha_1 \Gamma_{+,1}(k_x - k_y) + \alpha_2 k_z \Gamma_{+,3} + h.c.]; \\
A; & \{R_6, R_7\}; c_1 \Gamma_{0,0} + c_2[\Gamma_{0,2}(k_x - k_y) + \Gamma_{3,3}(k_x + k_y)] + [\alpha_1 \Gamma_{+,0}(k_x + k_y) - i\alpha_1 \Gamma_{+,1}(k_x - k_y) + \alpha_2 k_z \Gamma_{+,3} + h.c.]; \\
R; & R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
X; & R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
\Lambda; & R_5; c_2[(\sigma_3 - \sigma_1)k_x - (\sigma_1 + \sigma_3)k_y] + \sigma_0(c_3 k_z + c_1); \\
V; & R_5; c_2[(\sigma_3 - \sigma_1)k_x - (\sigma_1 + \sigma_3)k_y] + \sigma_0(c_3 k_z + c_1); \\
S; & \{R_2, R_4\}; [c_1 + c_2(k_x + k_y)]\sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2)(k_x - k_y) + c_5 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
U; \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
T; \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
W; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y;
\end{aligned}$$

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SG 113

$\Gamma_q; \{S_{4z}^+ | 000\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

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$$\begin{aligned}
\Gamma; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; \{R_6, R_7\}; & c_1 \Gamma_{0,0} - c_4 (\Gamma_{2,0} k_x + \Gamma_{1,1} k_y) + c_3 (\Gamma_{1,0} k_x - \Gamma_{2,1} k_y) + c_2 (\Gamma_{3,3} k_x - \Gamma_{0,2} k_y); \\
Z; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
A; \{R_6, R_7\}; & c_1 \Gamma_{0,0} - c_4 (\Gamma_{2,0} k_x + \Gamma_{1,1} k_y) + c_3 (\Gamma_{1,0} k_x - \Gamma_{2,1} k_y) + c_2 (\Gamma_{3,3} k_x - \Gamma_{0,2} k_y); \\
R; \{R_5, R_6\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
& \{R_7, R_8\}; (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
X; \{R_5, R_6\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
& \{R_7, R_8\}; (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
\Lambda; R_5; & c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + \sigma_0 (c_3 k_z + c_1); \\
V; \{R_5, R_5\}; & \Gamma_{0,0} (c_2 k_z + c_1) + c_3 [\Gamma_{0,1} (k_x + k_y) + \Gamma_{0,3} (k_x - k_y)] + \sum_{i=1}^3 [c_{i,1} \Gamma_{i,1} (k_x + k_y) - c_{i,2} \Gamma_{i,3} (k_x - k_y)]; \\
Y; \{R_5, R_7\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y; \\
T; \{R_5, R_7\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y; \\
W; \{R_2, R_4\}; & \sigma_0 (c_2 k_z + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x);
\end{aligned}$$

SG 114

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \quad & R_6; \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; \quad c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
M; \quad & \{R_6, R_7\}; \quad c_1 \Gamma_{0,0} - c_4 (\Gamma_{2,0} k_x + \Gamma_{1,1} k_y) + c_3 (\Gamma_{1,0} k_x - \Gamma_{2,1} k_y) + c_2 (\Gamma_{3,3} k_x - \Gamma_{0,2} k_y); \\
Z; \quad & \{R_6, R_7\}; \quad c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,2} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + [\alpha_1 \Gamma_{+,0} (k_x + k_y) - i \alpha_1 \Gamma_{+,1} (k_x - k_y) + \alpha_2 k_z \Gamma_{+,3} + h.c.]; \\
A; \quad & \{R_6, R_6\}; \quad c_1 \Gamma_{0,0} + \sum_{i=1}^3 c_{i,1} [\Gamma_{i,1} (k_x - k_y) + \Gamma_{i,3} (k_x + k_y)]; \\
& \{R_7, R_7\}; \quad c_1 \Gamma_{0,0} + \sum_{i=1}^3 c_{i,1} [\Gamma_{i,1} (k_x - k_y) - \Gamma_{i,3} (k_x + k_y)]; \\
R; \quad & \{R_5, R_6\}; \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
& \{R_7, R_8\}; \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
X; \quad & \{R_5, R_6\}; \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
& \{R_7, R_8\}; \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
\Lambda; \quad & R_5; \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + \sigma_0 (c_3 k_z + c_1); \\
V; \quad & \{R_5, R_5\}; \quad \Gamma_{0,0} (c_2 k_z + c_1) + c_3 [\Gamma_{0,1} (k_x + k_y) + \Gamma_{0,3} (k_x - k_y)] + \sum_{i=1}^3 [c_{i,1} \Gamma_{i,1} (k_x + k_y) - c_{i,2} \Gamma_{i,3} (k_x - k_y)]; \\
S; \quad & \{R_2, R_4\}; \quad [c_1 + c_2 (k_x + k_y)] \sigma_0 + (c_3 \sigma_1 - c_5 \sigma_2) (k_x - k_y) + c_4 \sigma_3 k_z; \\
Y; \quad & \{R_5, R_7\}; \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y; \\
T; \quad & \{R_2, R_4\}; \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y; \\
W; \quad & \{R_2, R_4\}; \quad \sigma_0 (c_2 k_z + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
U; \quad & \{R_5\}, \{R_7\}; \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Sigma; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x);
\end{aligned}$$

SG 115

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \quad & R_6; \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
& R_7; \quad c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
M; \quad & R_6; \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
& R_7; \quad c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
Z; \quad & R_6; \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
& R_7; \quad c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
A; \quad & R_6; \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
& R_7; \quad c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
R; \quad & R_5; \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
X; \quad & R_5; \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
\Lambda; \quad & R_5; \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; \quad & R_5; \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
W; \quad & R_5; \quad c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + \sigma_0 (c_4 k_z + c_1);
\end{aligned}$$



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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y; \\
T; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y;
\end{aligned}$$

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SG 116

$\Gamma_q; \{S_{4z}^+ | 000\}, \{C_{2a} | 00\frac{1}{2}\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_6; & c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
& R_7; c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
M; R_6; & c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
& R_7; c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
Z; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + \alpha_2 k_z \Gamma_{+,3} + h.c.]; \\
A; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + \alpha_2 k_z \Gamma_{+,3} + h.c.]; \\
R; \{R_9, R_9\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,2} k_x + c_{i,2} \Gamma_{i,1} k_y + c_{i,3} \Gamma_{i,0} k_z); \\
X; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
U; \{R_2, R_4\}; & (c_2 \sigma_1 - c_5 \sigma_2) k_x + c_4 \sigma_3 k_z + \sigma_0 (c_3 k_y + c_1); \\
\Lambda; R_5; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; R_5; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
T; \{R_2, R_4\}; & (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z + \sigma_0 (c_2 k_x + c_1); \\
W; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + \sigma_0 (c_4 k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
S; \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y;
\end{aligned}$$

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \quad R_6; \quad & c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
\quad R_7; \quad & c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
M; \quad \{R_6, R_7\}; \quad & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + \alpha_2 k_z \Gamma_{+,3} + h.c.]; \\
Z; \quad R_6; \quad & c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
\quad R_7; \quad & c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
A; \quad \{R_6, R_7\}; \quad & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + \alpha_2 k_z \Gamma_{+,3} + h.c.]; \\
R; \quad \{R_5, R_6\}; \quad & (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
\quad \{R_7, R_8\}; \quad & (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
X; \quad \{R_5, R_6\}; \quad & (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
\quad \{R_7, R_8\}; \quad & (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
\Lambda; \quad R_5; \quad & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; \quad R_9; \quad & c_2 (\sigma_2 k_x + \sigma_1 k_y) + \sigma_0 (c_3 k_z + c_1); \\
Y; \quad \{R_5, R_7\}; \quad & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z; \\
T; \quad \{R_5, R_7\}; \quad & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_4 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad \{R_2\}, \{R_4\}; \quad & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x; \\
U; \quad \{R_2\}, \{R_4\}; \quad & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x; \\
\Sigma; \quad \{R_2\}, \{R_4\}; \quad & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
S; \quad \{R_2\}, \{R_4\}; \quad & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
W; \quad \{R_5\}, \{R_6\}; \quad & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
\quad \{R_5\}, \{R_7\}; \quad & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
\quad \{R_5\}, \{R_8\}; \quad & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
\quad \{R_6\}, \{R_7\}; \quad & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
\quad \{R_6\}, \{R_8\}; \quad & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
\quad \{R_7\}, \{R_8\}; \quad & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x;
\end{aligned}$$

SG 118

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 $\Gamma_q; \{S_{4z}^+|000\}, \{C_{2a}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \quad R_6; & \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
& \quad R_7; \quad c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
M; \quad \{R_6, R_7\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + \alpha_2 k_z \Gamma_{+,3} + h.c.]; \\
Z; \quad \{R_6, R_7\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,2} k_x + \Gamma_{3,3} k_y) + [\alpha_1 (k_y \Gamma_{+,0} - i k_x \Gamma_{+,1}) + \alpha_2 k_z \Gamma_{+,3} + h.c.]; \\
A; \quad R_6; & \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
& \quad R_7; \quad c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
R; \quad \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \quad \{R_7, R_8\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_x + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
X; \quad \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& \quad \{R_7, R_8\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) k_y + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
U; \quad \{R_2, R_4\}; & \quad \sigma_0 (c_2 k_y + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_x + c_5 \sigma_3 k_z; \\
\Lambda; \quad R_5; & \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; \quad R_9; & \quad c_2 (\sigma_2 k_x + \sigma_1 k_y) + \sigma_0 (c_3 k_z + c_1); \\
Y; \quad \{R_5, R_7\}; & \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y + c_5 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x; \\
\Sigma; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
S; \quad \{R_5\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
T; \quad \{R_5\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y; \\
W; \quad \{R_5\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x; \\
& \quad \{R_5\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \quad \{R_5\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \quad \{R_6\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \quad \{R_6\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_y; \\
& \quad \{R_7\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) k_x;
\end{aligned}$$

SG 119

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 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2a}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \quad R_6; & \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
& \quad R_7; & \quad c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
N; \quad \{R_2, R_4\}; & \quad \sigma_3 (c_2 k_x + c_4 k_z) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_1 \sigma_0; \\
X; \quad R_5; & \quad c_3 \sigma_1 (k_x - k_y) + c_2 \sigma_3 (k_x + k_y) - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
Z; \quad R_6; & \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
& \quad R_7; & \quad c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
\Lambda; \quad R_5; & \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; \quad R_5; & \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
W; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 (k_x + k_y) + c_5 \sigma_2 (k_y - k_x); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y; \\
F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 c_3 (k_x - k_y) + c_4 \sigma_1 (k_x + k_y) + c_5 \sigma_2 k_z;
\end{aligned}$$

SG 120

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 $\Gamma_q^v; \{S_{4z}^+ | 000\}, \{C_{2a} | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_6; & c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
R_7; & c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
N; \{R_5, R_5\}; & \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z) \sigma_i + c_1 \sigma_0; \\
\{R_7, R_7\}; & \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z) \sigma_i + c_1 \sigma_0; \\
X; R_5; & c_3 \sigma_1 (k_x - k_y) + c_2 \sigma_3 (k_x + k_y) - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
Z; R_6; & c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + c_1 \sigma_0; \\
R_7; & c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_y] + c_1 \sigma_0; \\
P; \{R_2, R_6\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\{R_4, R_8\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\Lambda; R_5; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
V; R_5; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
Q; \{R_2, R_2\}; & \sigma_0 (c_2 k_y + c_1) + \sum_{i=1}^3 (c_{i,1} k_x + c_{i,2} k_z) \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
W; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 (k_x + k_y) + c_5 \sigma_2 (k_y - k_x); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y; \\
F; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 k_z + c_5 \sigma_2 (k_y - k_x); \\
Y; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 c_3 (k_x - k_y) + c_4 \sigma_1 (k_x + k_y) + c_5 \sigma_2 k_z;
\end{aligned}$$

## SG 121

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 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2x}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
 \Gamma; R_6; & \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
 R_7; & \quad c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
 N; \{R_2, R_4\}; & \quad \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z) + c_2 \sigma_3 k_y + c_1 \sigma_0; \\
 X; R_5; & \quad c_3 \sigma_1 (k_x + k_y) + c_2 \sigma_3 (k_x - k_y) + c_1 \sigma_0; \\
 Z; R_6; & \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
 R_7; & \quad c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
 P; R_6; & \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
 R_7; & \quad c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
 \Lambda; R_5; & \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + \sigma_0 (c_3 k_z + c_1); \\
 V; R_5; & \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + \sigma_0 (c_3 k_z + c_1); \\
 W; R_5; & \quad c_3 \sigma_1 (k_x + k_y) + c_2 \sigma_3 (k_x - k_y) + \sigma_0 (c_4 k_z + c_1);
 \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Sigma; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
 F; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
 Q; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\
 \Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
 U; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x); \\
 Y; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 c_3 (k_x - k_y) + c_4 \sigma_1 (k_x + k_y);
 \end{aligned}$$

## SG 122

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 $\Gamma_q^v; \{S_{4z}^+|000\}, \{C_{2x}|\frac{1}{4}\frac{3}{4}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
 \Gamma; R_6; & \quad c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
 R_7; & \quad c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
 N; \{R_2, R_4\}; & \quad \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z) + c_2 \sigma_3 k_y + c_1 \sigma_0; \\
 X; \{R_5, R_6\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) (k_x + k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
 \{R_7, R_8\}; & \quad (c_2 \sigma_1 - c_4 \sigma_2) (k_x + k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
 Z; \{R_6, R_7\}; & \quad c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,2} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + [\alpha_1 \Gamma_{+,0} (k_x + k_y) - i \alpha_1 \Gamma_{+,1} (k_x - k_y) + \alpha_2 k_z \Gamma_{+,3} + h.c.]; \\
 R_{20}; & \quad c_2 \sigma_3 k_z + c_1 \sigma_0; \\
 \Lambda; R_5; & \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + \sigma_0 (c_3 k_z + c_1); \\
 V; R_5; & \quad c_2 [(\sigma_3 - \sigma_1) k_x - (\sigma_1 + \sigma_3) k_y] + \sigma_0 (c_3 k_z + c_1); \\
 U; \{R_2, R_4\}; & \quad [c_1 + c_2 (k_x + k_y)] \sigma_0 + (c_3 \sigma_1 - c_5 \sigma_2) (k_x - k_y) + c_4 \sigma_3 k_z; \\
 Y; \{R_5, R_7\}; & \quad [c_1 + c_2 (k_x - k_y)] \sigma_0 + (c_3 \sigma_1 - c_5 \sigma_2) (k_x + k_y) + c_4 \sigma_3 k_z;
 \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
W; \{R_5\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x - k_y); \\
\{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x + k_y); \\
\{R_5\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
\{R_6\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x + k_y); \\
\{R_7\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x - k_y); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
F; \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
Q; \{R_{10}\}, \{R_{14}\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_2 (k_y - k_x);
\end{aligned}$$

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SG 123

$$\Gamma_q; \{C_{4z}^+ | 000\}, \{C_{2x} | 000\}, \{I | 000\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
V; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y);
\end{aligned}$$

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SG 124

$$\Gamma_q; \{C_{4z}^+ | 000\}, \{C_{2x} | 000\}, \{I | 00\frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$$

$$\begin{aligned}
Z; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + \sum_{i=1}^2 c_{i,1} \Gamma_{i,0} k_z; \\
\{R_{21}, R_{22}\}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + \sum_{i=1}^2 c_{i,1} \Gamma_{i,0} k_z; \\
A; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + \sum_{i=1}^2 c_{i,1} \Gamma_{i,0} k_z; \\
\{R_{21}, R_{22}\}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + \sum_{i=1}^2 c_{i,1} \Gamma_{i,0} k_z; \\
R; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} - c_4 \Gamma_{0,2} k_x + c_2 \Gamma_{3,1} k_y + k_z (c_3 \Gamma_{1,1} - c_5 \Gamma_{2,1});
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
U; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_z (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}); \\
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
V; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
S; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_x + c_2 k_y) + \Gamma_{3,0} c_3 (k_x + k_y) + (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) (k_x - k_y) + (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}) k_z; \\
T; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_z (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2});
\end{aligned}$$

## SG 125

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 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
 M; R_{19}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z; \\
 A; R_{19}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z; \\
 R; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} - c_4 \Gamma_{0,2} k_x + k_y (c_2 \Gamma_{1,1} - c_5 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_z; \\
 X; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} - c_4 \Gamma_{0,2} k_x + k_y (c_2 \Gamma_{1,1} - c_5 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_z;
 \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Lambda; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
 V; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,1} k_x + \Gamma_{1,0} k_y); \\
 Y; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \\
 T; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \\
 W; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_y (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2});
 \end{aligned}$$

## SG 126

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 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
 M; R_{19}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z; \\
 Z; \{R_{19}, R_{20}\}; & \quad c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + \sum_{i=1}^2 c_{i,1} \Gamma_{i,0} k_z; \\
 & \quad \{R_{21}, R_{22}\}; c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + \sum_{i=1}^2 c_{i,1} \Gamma_{i,0} k_z; \\
 A; R_{19}; & \quad c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,3} (k_x - k_y) - \Gamma_{0,2} (k_x + k_y)] + c_3 \Gamma_{3,1} k_z; \\
 R; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} + k_x (c_2 \Gamma_{1,1} - c_4 \Gamma_{2,1}) - c_5 \Gamma_{0,2} k_y + c_3 \Gamma_{3,1} k_z; \\
 X; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} - c_4 \Gamma_{0,2} k_x + k_y (c_2 \Gamma_{1,1} - c_5 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_z;
 \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 U; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_z (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}); \\
 \Lambda; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
 V; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,1} k_x + \Gamma_{1,0} k_y); \\
 S; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x + c_2 k_y) + \Gamma_{3,0} c_3 (k_x + k_y) + (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) (k_x - k_y) + (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}) k_z; \\
 Y; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \\
 W; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_y (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2});
 \end{aligned}$$

SG 127

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 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
 M; \{R_6, R_7\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
 & \{R_{20}, R_{21}\}; (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
 A; \{R_6, R_7\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
 & \{R_{20}, R_{21}\}; (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
 R; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + k_y (c_2 \Gamma_{1,1} - c_4 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_z; \\
 X; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + k_y (c_2 \Gamma_{1,1} - c_4 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_z; \\
 V; \{R_6, R_7\}; & \Gamma_{0,0} (c_3 k_z + c_1) - c_2 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y); \\
 Y; \{R_9, R_9\}; & (c_1 + c_2 k_x) \Gamma_{0,0} + c_3 \Gamma_{0,2} k_z + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_y; \\
 T; \{R_9, R_9\}; & (c_1 + c_2 k_x) \Gamma_{0,0} + c_3 \Gamma_{0,2} k_z + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_y;
 \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
 W; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_y (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2});
 \end{aligned}$$

SG 128

---

 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 00 \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
 M; \{R_6, R_7\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
 & \{R_{20}, R_{21}\}; (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
 Z; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + k_z (c_3 \Gamma_{1,0} - c_4 \Gamma_{2,0}); \\
 & \{R_{21}, R_{22}\}; c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)] + k_z (c_3 \Gamma_{1,0} - c_4 \Gamma_{2,0}); \\
 A; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)]; \\
 & \{R_{21}, R_{22}\}; c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)]; \\
 X; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + k_y (c_2 \Gamma_{1,1} - c_4 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_z; \\
 V; \{R_6, R_7\}; & \Gamma_{0,0} (c_3 k_z + c_1) - c_2 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y); \\
 Y; \{R_9, R_9\}; & (c_1 + c_2 k_x) \Gamma_{0,0} + c_3 \Gamma_{0,2} k_z + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_y;
 \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 U; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_z (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}); \\
 \Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
 S; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_x + c_2 k_y) + \Gamma_{3,0} c_3 (k_x + k_y) + (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) (k_x - k_y) + (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}) k_z; \\
 T; \{R_6, R_8\}, \{R_7, R_9\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}); \\
 W; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_y (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3});
 \end{aligned}$$



SG 129

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 $\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
 M; R_{19}; & \quad c_1\Gamma_{0,0} - c_2(\Gamma_{0,2}k_x + \Gamma_{0,3}k_y); \\
 A; R_{19}; & \quad c_1\Gamma_{0,0} - c_2(\Gamma_{0,2}k_x + \Gamma_{0,3}k_y); \\
 R; \{R_{13}, R_{14}\}; & \quad c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_x + k_y(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
 X; \{R_{13}, R_{14}\}; & \quad c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_x + k_y(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
 V; \{R_6, R_7\}; & \quad c_2(\Gamma_{0,1}k_x + \Gamma_{0,3}k_y) + \Gamma_{0,0}(c_3k_z + c_1); \\
 W; \{R_5, R_5\}; & \quad (c_1 + c_2k_z)\Gamma_{0,0} + c_3\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_y;
 \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Lambda; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{1,0}k_x + \Gamma_{2,2}k_y); \\
 Y; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{2,1} + c_5\Gamma_{2,2}); \\
 T; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{2,1} + c_5\Gamma_{2,2});
 \end{aligned}$$

SG 130

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 $\Gamma_q; \{C_{4z}^+|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
 M; R_{19}; & \quad c_1\Gamma_{0,0} - c_2(\Gamma_{0,2}k_x + \Gamma_{0,3}k_y); \\
 Z; \{R_{19}, R_{20}\}; & \quad c_1\Gamma_{0,0} + c_2[\Gamma_{3,1}(k_x - k_y) + \Gamma_{3,3}(k_x + k_y)] + k_z(c_3\Gamma_{1,0} - c_4\Gamma_{2,0}); \\
 & \quad \{R_{21}, R_{22}\}; c_1\Gamma_{0,0} + c_2[\Gamma_{3,1}(k_x - k_y) + \Gamma_{3,3}(k_x + k_y)] + k_z(c_3\Gamma_{1,0} - c_4\Gamma_{2,0}); \\
 A; \{R_{19}, R_{19}\}; & \quad c_1Q_{0,0,0} + c_2(Q_{0,3,1}k_x + Q_{0,3,3}k_y) + \sum_{i=1}^3 [c_{i,1}(Q_{i,2,1}k_x - Q_{i,2,3}k_y) + c_{i,2}Q_{i,3,2}k_z]; \\
 R; \{R_9, R_9\}; & \quad c_1\Gamma_{0,0} + k_y(c_3\Gamma_{1,1} - c_4\Gamma_{2,1} + c_2\Gamma_{3,1}); \\
 & \quad \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + k_y(c_3\Gamma_{1,1} - c_4\Gamma_{2,1} + c_2\Gamma_{3,1}); \\
 X; \{R_{13}, R_{14}\}; & \quad c_1\Gamma_{0,0} - c_3\Gamma_{0,2}k_x + k_y(c_2\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
 V; \{R_6, R_7\}; & \quad c_2(\Gamma_{0,1}k_x + \Gamma_{0,3}k_y) + \Gamma_{0,0}(c_3k_z + c_1); \\
 T; \{R_9, R_9\}; & \quad (c_1 + c_2k_x)\Gamma_{0,0} + c_3\Gamma_{0,3}k_z + \sum_{i=1}^3 c_{i,1}\Gamma_{i,1}k_y; \\
 W; \{R_5, R_5\}; & \quad (c_1 + c_2k_z)\Gamma_{0,0} + c_3\Gamma_{0,1}k_x + \sum_{i=1}^3 c_{i,1}\Gamma_{i,3}k_y;
 \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 U; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2}); \\
 \Lambda; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{1,0}k_x + \Gamma_{2,2}k_y); \\
 S; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0}(c_1 + c_2k_x + c_2k_y) + \Gamma_{3,0}c_3(k_x + k_y) + (c_4\Gamma_{1,0} + c_5\Gamma_{2,3})(k_x - k_y) + (c_6\Gamma_{2,1} + c_7\Gamma_{2,2})k_z; \\
 Y; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{2,1} + c_5\Gamma_{2,2});
 \end{aligned}$$

## 15. SG 131-140

## SG 131

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 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{C_{2x}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$Z; R_{19}; c_1\Gamma_{0,0} + c_2[\Gamma_{0,3}(k_x - k_y) - \Gamma_{0,2}(k_x + k_y)] + c_3\Gamma_{3,1}k_z;$$

$$A; R_{19}; c_1\Gamma_{0,0} + c_2[\Gamma_{0,3}(k_x - k_y) - \Gamma_{0,2}(k_x + k_y)] + c_3\Gamma_{3,1}k_z;$$

---

Accidental degeneracies on high symmetry line

$$\Lambda; \{R_6\}, \{R_7\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{1,0}k_x + \Gamma_{2,2}k_y);$$

$$V; \{R_6\}, \{R_7\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{1,0}k_x + \Gamma_{2,2}k_y);$$

$$S; \{R_5, R_6\}, \{R_7, R_8\}; \Gamma_{0,0}(c_1 + c_2k_x + c_2k_y) + \Gamma_{3,0}c_3(k_x + k_y) + (c_4\Gamma_{2,1} + c_5\Gamma_{2,2})(k_x - k_y) + (c_6\Gamma_{1,0} + c_7\Gamma_{2,3})k_z;$$

## SG 132

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 $\Gamma_q; \{C_{4z}^+|00\frac{1}{2}\}, \{C_{2x}|000\}, \{I|00\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$Z; R_{19}; c_1\Gamma_{0,0} + c_2(\Gamma_{0,3}k_x - \Gamma_{0,2}k_y) + c_3\Gamma_{3,1}k_z;$$

$$A; R_{19}; c_1\Gamma_{0,0} + c_2(\Gamma_{0,3}k_x - \Gamma_{0,2}k_y) + c_3\Gamma_{3,1}k_z;$$

$$R; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + c_2\Gamma_{3,1}k_y + k_z(c_3\Gamma_{1,1} - c_5\Gamma_{2,1});$$

---

Accidental degeneracies on high symmetry line

$$U; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_y) + \Gamma_{3,0}c_3k_y + k_x(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2});$$

$$\Lambda; \{R_6\}, \{R_7\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{1,0}k_x + \Gamma_{2,2}k_y);$$

$$V; \{R_6\}, \{R_7\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{1,0}k_x + \Gamma_{2,2}k_y);$$

$$T; \{R_5, R_8\}, \{R_6, R_7\}; \Gamma_{0,0}(c_1 + c_2k_x) + \Gamma_{3,0}c_3k_x + k_y(c_4\Gamma_{1,0} + c_5\Gamma_{2,3}) + k_z(c_6\Gamma_{2,1} + c_7\Gamma_{2,2});$$

## SG 133

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 $\Gamma_q; \{C_{4z}^+|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{C_{2x}|000\}, \{I|\frac{1}{2}\frac{1}{2}0\}, \mathcal{T};$  Centrosymmetric; with SOC

$$M; R_{19}; c_1\Gamma_{0,0} + c_2(\Gamma_{0,3}k_x - \Gamma_{0,2}k_y) + c_3\Gamma_{3,1}k_z;$$

$$Z; R_{19}; c_1\Gamma_{0,0} + c_2[\Gamma_{0,3}(k_x - k_y) - \Gamma_{0,2}(k_x + k_y)] + c_3\Gamma_{3,1}k_z;$$

$$A; \{R_{19}, R_{20}\}; c_1\Gamma_{0,0} + c_2(\Gamma_{3,1}k_x + \Gamma_{3,3}k_y) + k_z(c_3\Gamma_{1,0} - c_4\Gamma_{2,0});$$

$$\{R_{21}, R_{22}\}; c_1\Gamma_{0,0} + c_2(\Gamma_{3,1}k_x + \Gamma_{3,3}k_y) + k_z(c_3\Gamma_{1,0} - c_4\Gamma_{2,0});$$

$$R; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + k_y(c_2\Gamma_{1,1} - c_5\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z;$$

$$X; \{R_{13}, R_{14}\}; c_1\Gamma_{0,0} - c_4\Gamma_{0,2}k_x + k_y(c_2\Gamma_{1,1} - c_5\Gamma_{2,1}) + c_3\Gamma_{3,1}k_z;$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
V; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,1} k_x + \Gamma_{1,0} k_y); \\
S; \{R_5, R_6\}, \{R_7, R_8\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x + c_2 k_y) + \Gamma_{3,0} c_3 (k_x + k_y) + (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) (k_x - k_y) + (c_6 \Gamma_{1,0} + c_7 \Gamma_{2,3}) k_z; \\
Y; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \\
T; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \\
W; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_y (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2});
\end{aligned}$$

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SG 134

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
M; R_{19}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z; \\
Z; R_{19}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z; \\
R; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} + k_x (c_2 \Gamma_{1,1} - c_4 \Gamma_{2,1}) - c_5 \Gamma_{0,2} k_y + c_3 \Gamma_{3,1} k_z; \\
X; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} - c_4 \Gamma_{0,2} k_x + k_y (c_2 \Gamma_{1,1} - c_5 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_z;
\end{aligned}$$

---

Accidental degeneracies on high symmetry line

$$\begin{aligned}
U; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_z (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}); \\
\Lambda; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
V; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,1} k_x + \Gamma_{1,0} k_y); \\
Y; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \\
W; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_y (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2});
\end{aligned}$$

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SG 135

$\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
M; \{R_6, R_7\}; & \quad (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
& \quad \{R_{20}, R_{21}\}; (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
Z; R_{19}; & \quad c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,3} (k_x - k_y) - \Gamma_{0,2} (k_x + k_y)] + c_3 \Gamma_{3,1} k_z; \\
A; \{R_{19}, R_{19}\}; & \quad c_1 Q_{0,0,0} + c_2 (Q_{0,3,1} k_x + Q_{0,3,3} k_y) + \sum_{i=1}^3 [c_{i,1} (Q_{i,2,1} k_x - Q_{i,2,3} k_y) + c_{i,2} Q_{i,3,2} k_z]; \\
R; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} + k_y (c_2 \Gamma_{1,1} - c_4 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_z; \\
X; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} + k_y (c_2 \Gamma_{1,1} - c_4 \Gamma_{2,1}) + c_3 \Gamma_{3,1} k_z; \\
V; \{R_6, R_7\}; & \quad (c_1 + c_2 k_z) \Gamma_{0,0} + c_3 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y); \\
Y; \{R_9, R_9\}; & \quad (c_1 + c_2 k_x) \Gamma_{0,0} + c_3 \Gamma_{0,2} k_z + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_y; \\
T; \{R_9, R_9\}; & \quad (c_1 + c_2 k_x) \Gamma_{0,0} + c_3 \Gamma_{0,2} k_z + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
S; \{R_5, R_6\}, \{R_7, R_8\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x + c_2 k_y) + \Gamma_{3,0} c_3 (k_x + k_y) + (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) (k_x - k_y) + (c_6 \Gamma_{1,0} + c_7 \Gamma_{2,3}) k_z; \\
W; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_y (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2});
\end{aligned}$$

SG 136

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 $\Gamma_q; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 00 \frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$$\begin{aligned}
M; \{R_6, R_7\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
& \{R_{20}, R_{21}\}; (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
Z; R_{19}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z; \\
A; R_{19}; & c_1 \Gamma_{0,0} - c_2 (\Gamma_{0,2} k_x + \Gamma_{0,3} k_y); \\
X; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + k_y (c_2 \Gamma_{1,1} - c_3 \Gamma_{2,1}) + c_4 \Gamma_{3,1} k_z; \\
V; \{R_6, R_7\}; & (c_1 + c_2 k_z) \Gamma_{0,0} + c_3 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y); \\
Y; \{R_9, R_9\}; & (c_1 + c_2 k_x) \Gamma_{0,0} + c_3 \Gamma_{0,2} k_z + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
U; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_z (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}); \\
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
T; \{R_6, R_9\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}); \\
W; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_y (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3});
\end{aligned}$$

SG 137

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 $\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$$\begin{aligned}
M; R_{19}; & c_1 \Gamma_{0,0} - c_2 (\Gamma_{0,2} k_x + \Gamma_{0,3} k_y); \\
Z; R_{19}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,3} (k_x - k_y) - \Gamma_{0,2} (k_x + k_y)] + c_3 \Gamma_{3,1} k_z; \\
A; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)]; \\
& \{R_{21}, R_{22}\}; c_1 \Gamma_{0,0} + c_2 [\Gamma_{3,1} (k_x - k_y) + \Gamma_{3,3} (k_x + k_y)]; \\
R; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_x + k_y (c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1}); \\
X; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_x + k_y (c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1}); \\
V; \{R_6, R_7\}; & (c_1 + c_2 k_z) \Gamma_{0,0} + c_3 (\Gamma_{0,1} k_x + \Gamma_{0,3} k_y); \\
W; \{R_5, R_5\}; & (c_1 + c_2 k_z) \Gamma_{0,0} + c_3 \Gamma_{0,1} k_x + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
S; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x + c_2 k_y) + \Gamma_{3,0} c_3 (k_x + k_y) + (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) (k_x - k_y) + (c_6 \Gamma_{1,0} + c_7 \Gamma_{2,3}) k_z; \\
Y; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}); \\
T; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2});
\end{aligned}$$

SG 138

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 $\Gamma_q; \{C_{4z}^+ | 00 \frac{1}{2}\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$$\begin{aligned}
 M; R_{19}; & \quad c_1 \Gamma_{0,0} - c_2 (\Gamma_{0,2} k_x + \Gamma_{0,3} k_y); \\
 Z; R_{19}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x - \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z; \\
 A; \{R_6, R_7\}; & \quad (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
 & \quad \{R_{20}, R_{21}\}; (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + (c_4 \Gamma_{1,2} + c_5 \Gamma_{2,2}) k_x k_y + c_6 (\Gamma_{3,2} k_x + \Gamma_{0,3} k_y) k_z; \\
 R; \{R_9, R_9\}; & \quad c_1 \Gamma_{0,0} + k_y (c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1} + c_2 \Gamma_{3,1}); \\
 & \quad \{R_{10}, R_{10}\}; c_1 \Gamma_{0,0} + k_y (c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1} + c_2 \Gamma_{3,1}); \\
 X; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_x + k_y (c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1}); \\
 V; \{R_6, R_7\}; & \quad (c_1 + c_2 k_z) \Gamma_{0,0} + c_3 (\Gamma_{0,1} k_x + \Gamma_{0,3} k_y); \\
 T; \{R_9, R_9\}; & \quad (c_1 + c_2 k_x) \Gamma_{0,0} + c_3 \Gamma_{0,3} k_z + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_y; \\
 W; \{R_5, R_5\}; & \quad (c_1 + c_2 k_z) \Gamma_{0,0} + c_3 \Gamma_{0,1} k_x + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_y;
 \end{aligned}$$

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 Accidental degeneracies on high symmetry line

$$\begin{aligned}
 U; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) + k_z (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}); \\
 \Lambda; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
 Y; \{R_5, R_7\}, \{R_6, R_8\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2});
 \end{aligned}$$

SG 139

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 $\Gamma_q^v; \{C_{4z}^+ | 000\}, \{C_{2x} | 000\}, \{I | 000\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 


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 Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Lambda; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
 V; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y);
 \end{aligned}$$

SG 140

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 $\Gamma_q^v; \{C_{4z}^+ | \frac{1}{2} \frac{1}{2} 0\}, \{C_{2x} | 000\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 

$$\begin{aligned}
 N; \{R_9, R_9\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_y + \sum_{i=1}^3 \Gamma_{i,1} (c_{i,1} k_x + c_{i,2} k_z); \\
 P; \{R_6, R_7\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,1} k_x + \Gamma_{0,3} k_y) + k_z (c_4 \Gamma_{1,2} + c_3 \Gamma_{2,2});
 \end{aligned}$$

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 Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Lambda; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
 V; \{R_6\}, \{R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\
 Q; \{R_2, R_2\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + \Gamma_{1,0} (c_4 k_x + c_5 k_z) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1} k_x + c_{i,2} k_z);
 \end{aligned}$$

## 16. SG 141-150

## SG 141

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 $\Gamma_q^-; \{C_{4z}^+ | 0 \frac{1}{2} 0\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | \frac{1}{2} \frac{1}{2} 0\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} X; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} (k_x - k_y) + c_3 \Gamma_{3,1} k_z + \sum_{i=1}^2 c_{i,1} \Gamma_{i,1} (k_x + k_y); \\ Z; R_{19}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,3} (k_x - k_y) - \Gamma_{0,2} (k_x + k_y)] + c_3 \Gamma_{3,1} k_z; \end{aligned}$$


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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\ V; \{R_{13}\}, \{R_{14}\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_y - \Gamma_{2,2} k_x); \\ W; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) (k_x + k_y) + (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}) (k_x - k_y); \\ U; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x + c_2 k_y) + \Gamma_{3,0} c_3 (k_x + k_y) + (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) (k_x - k_y) + (c_6 \Gamma_{1,0} + c_7 \Gamma_{2,3}) k_z; \\ Y; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x - c_2 k_y) + \Gamma_{3,0} c_3 (k_x - k_y) + (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) (k_x + k_y) + (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}) k_z; \end{aligned}$$


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## SG 142

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 $\Gamma_q^-; \{C_{4z}^+ | \frac{1}{2} 0 0\}, \{C_{2x} | \frac{1}{2} \frac{1}{2} 0\}, \{I | 0 0 0\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} N; \{R_{10}, R_{10}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_y + \sum_{i=1}^3 \Gamma_{i,1} (c_{i,1} k_x + c_{i,2} k_z); \\ X; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^2 c_{i,1} \Gamma_{i,1} (k_x + k_y) + c_2 \Gamma_{3,1} (k_x - k_y) + c_3 \Gamma_{0,2} k_z; \\ Z; R_{19}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,3} (k_x - k_y) - \Gamma_{0,2} (k_x + k_y)] + c_3 \Gamma_{3,1} k_z; \\ P; \{R_{19}, R_{19}\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + c_4 \Gamma_{0,1} (k_x^2 - k_y^2) + \sum_{i=1}^3 \Gamma_{i,2} (c_{i,1} k_x k_y + c_{i,2} k_z); \end{aligned}$$


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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \\ V; \{R_{13}\}, \{R_{14}\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_y - \Gamma_{2,2} k_x); \\ W; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) (k_x + k_y) + (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}) (k_x - k_y); \\ Q; \{R_5, R_5\}, \{R_7, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + \Gamma_{1,0} (c_4 k_x + c_5 k_z) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1} k_x + c_{i,2} k_z); \\ U; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x + c_2 k_y) + \Gamma_{3,0} c_3 (k_x + k_y) + (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) (k_x - k_y) + (c_6 \Gamma_{1,0} + c_7 \Gamma_{2,3}) k_z; \\ Y; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x - c_2 k_y) + \Gamma_{3,0} c_3 (k_x - k_y) + (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) (k_x + k_y) + (c_6 \Gamma_{2,1} + c_7 \Gamma_{2,2}) k_z; \end{aligned}$$


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## SG 143

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 $\Gamma_h; \{C_3^+ | 0 0 0\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned} \Gamma; \{R_2, R_6\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\ & \{R_4, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^3 \sigma_i [(c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) k_z + c_{i,4} k_x (k_x^2 - 3k_y^2) + c_{i,5} k_y (3k_x^2 - k_y^2)]; \\ M; \{R_2, R_2\}; & c_1 \sigma_0 + \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z); \\ A; \{R_2, R_6\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\ & \{R_4, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^3 \sigma_i [(c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) k_z + c_{i,4} k_x (k_x^2 - 3k_y^2) + c_{i,5} k_y (3k_x^2 - k_y^2)]; \\ L; \{R_2, R_2\}; & c_1 \sigma_0 + \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&\{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
&\{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&P; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&\{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
&\{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y);
\end{aligned}$$

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SG 144

 $\Gamma_h; \{C_3^+ | 00 \frac{1}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
&\Gamma; \{R_2, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
&\{R_4, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^3 \sigma_i [(c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) k_z + c_{i,4} k_x (k_x^2 - 3k_y^2) + c_{i,5} k_y (3k_x^2 - k_y^2)]; \\
&M; \{R_2, R_2\}; c_1 \sigma_0 + \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z); \\
&A; \{R_2, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
&\{R_4, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^3 \sigma_i [(c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) k_z + c_{i,4} k_x (k_x^2 - 3k_y^2) + c_{i,5} k_y (3k_x^2 - k_y^2)]; \\
&L; \{R_2, R_2\}; c_1 \sigma_0 + \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&\{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
&\{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&P; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&\{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
&\{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y);
\end{aligned}$$

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SG 145

 $\Gamma_h; \{C_3^+ | 00 \frac{2}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
&\Gamma; \{R_2, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
&\{R_4, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^3 \sigma_i [(c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) k_z + c_{i,4} k_x (k_x^2 - 3k_y^2) + c_{i,5} k_y (3k_x^2 - k_y^2)]; \\
&M; \{R_2, R_2\}; c_1 \sigma_0 + \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z); \\
&A; \{R_2, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
&\{R_4, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^3 \sigma_i [(c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) k_z + c_{i,4} k_x (k_x^2 - 3k_y^2) + c_{i,5} k_y (3k_x^2 - k_y^2)]; \\
&L; \{R_2, R_2\}; c_1 \sigma_0 + \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&\{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
&\{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&P; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&\{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
&\{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y);
\end{aligned}$$

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SG 146

$\Gamma_{rh}; \{C_3^+|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
&\Gamma; \{R_2, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
&\{R_4, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^3 \sigma_i [(c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) k_z + c_{i,4} k_x (k_x^2 - 3k_y^2) + c_{i,5} k_y (3k_x^2 - k_y^2)]; \\
&Z; \{R_2, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
&\{R_4, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sum_{i=1}^3 \sigma_i [(c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) k_z + c_{i,4} k_x (k_x^2 - 3k_y^2) + c_{i,5} k_y (3k_x^2 - k_y^2)]; \\
&L; \{R_2, R_2\}; c_1 \sigma_0 + \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z); \\
&(a)F; \{R_2, R_2\}; c_1 \sigma_0 + \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z); \\
&(b)F; \{R_2, R_2\}; c_1 \sigma_0 + \sum_{i=1}^3 \sigma_i (c_{i,1} k_x + c_{i,2} k_y + c_{i,3} k_z);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&\{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
&\{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&P; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&\{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
&\{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y);
\end{aligned}$$

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SG 147

$\Gamma_h; \{S_6^+|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2, R_6\}, \{R_4, R_4\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x) + (\alpha_1 \Gamma_{2,+} k_- + h.c.); \\
&P; \{R_2, R_6\}, \{R_4, R_4\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x) + (\alpha_1 \Gamma_{2,+} k_- + h.c.);
\end{aligned}$$

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SG 148

$\Gamma_{rh}; \{S_6^+|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC



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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_2, R_6\}, \{R_4, R_4\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x) + (\alpha_1 \Gamma_{2,+} k_- + h.c.); \\ P; \{R_2, R_6\}, \{R_4, R_4\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x) + (\alpha_1 \Gamma_{2,+} k_- + h.c.); \end{aligned}$$

## SG 149

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 $\Gamma_h; \{C_3^+ | 000\}, \{C_{21}' | 000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned} \Gamma; \{R_3, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x (k_x^2 - 3k_y^2) + \{\sigma_+ [\alpha_1 k_y (k_y^2 - 3k_x^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\ R_6; c_2 (\sigma_3 k_x + \sigma_1 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ M; \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\ A; \{R_3, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x (k_x^2 - 3k_y^2) + \{\sigma_+ [\alpha_1 k_y (k_y^2 - 3k_x^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\ R_6; c_2 (\sigma_3 k_x + \sigma_1 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ L; \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\ \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i - \sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\ \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\ P; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\ \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i - \sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\ \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\ \Sigma; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\ R; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \end{aligned}$$

## SG 150

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 $\Gamma_h; \{C_3^+ | 000\}, \{C_{21}'' | 000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned} \Gamma; \{R_3, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_y (k_y^2 - 3k_x^2) + \{\sigma_+ [\alpha_1 k_x (k_x^2 - 3k_y^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\ R_6; c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ M; \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\ A; \{R_3, R_4\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_y (k_y^2 - 3k_x^2) + \{\sigma_+ [\alpha_1 k_x (k_x^2 - 3k_y^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\ R_6; c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ L; \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\ K; R_6; c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ H; R_6; c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 - i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\
&\quad \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 - i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
&P; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&T; \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (k_x - \sqrt{3} k_y) + c_{i,2} k_z]; \\
&S; \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (k_x - \sqrt{3} k_y) + c_{i,2} k_z]; \\
&T'; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\
&S'; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z);
\end{aligned}$$

## SG 151

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 $\Gamma_h; \{C_3^+|00\frac{1}{3}\}, \{C_{21}'|00\frac{2}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned} \Gamma; \{R_3, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x (k_x^2 - 3k_y^2) + \{\sigma_+ [\alpha_1 k_y (k_y^2 - 3k_x^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\ R_6; & c_2 (\sigma_3 k_x + \sigma_1 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ M; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\ A; \{R_3, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x (k_x^2 - 3k_y^2) + \{\sigma_+ [\alpha_1 k_y (k_y^2 - 3k_x^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\ R_6; & c_2 (\sigma_3 k_x - \sigma_1 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ L; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\ \{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i - \sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\ \{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\ P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\ \{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i - \sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\ \{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\ \Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\ R; \{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \end{aligned}$$

## SG 152

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 $\Gamma_h; \{C_3^+|00\frac{1}{3}\}, \{C_{21}''|00\frac{2}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned} \Gamma; \{R_3, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_y (k_y^2 - 3k_x^2) + \{\sigma_+ [\alpha_1 k_x (k_x^2 - 3k_y^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\ R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ M; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\ A; \{R_3, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_y (k_y^2 - 3k_x^2) + \{\sigma_+ [\alpha_1 k_x (k_x^2 - 3k_y^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\ R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ L; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\ K; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\ H; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 - i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 - i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
T; \{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (k_x - \sqrt{3} k_y) + c_{i,2} k_z]; \\
S; \{R_6\}, \{R_{12}\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (k_x - \sqrt{3} k_y) + c_{i,2} k_z]; \\
T'; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\
S'; \{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z);
\end{aligned}$$

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SG 153

 $\Gamma_h; \{C_3^+ | 00 \frac{2}{3}\}, \{C_{21}' | 00 \frac{1}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \{R_3, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x (k_x^2 - 3k_y^2) + \{\sigma_+ [\alpha_1 k_y (k_y^2 - 3k_x^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\
R_6; & c_2 (\sigma_3 k_x + \sigma_1 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
M; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\
A; \{R_3, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x (k_x^2 - 3k_y^2) + \{\sigma_+ [\alpha_1 k_y (k_y^2 - 3k_x^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\
R_6; & c_2 (\sigma_3 k_x + \sigma_1 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
L; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i - \sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i - \sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\
R; \{R_6\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z);
\end{aligned}$$

SG 154

 $\Gamma_h; \{C_3^+|00\frac{2}{3}\}, \{C_{21}''|00\frac{1}{3}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \{R_3, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_y (k_y^2 - 3k_x^2) + \{\sigma_+ [\alpha_1 k_x (k_x^2 - 3k_y^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\
R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
M; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\
A; \{R_3, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_y (k_y^2 - 3k_x^2) + \{\sigma_+ [\alpha_1 k_x (k_x^2 - 3k_y^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\
R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
L; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\
K; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
H; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 - i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 - i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
T; \{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (k_x - \sqrt{3} k_y) + c_{i,2} k_z]; \\
S; \{R_2\}, \{R_8\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sigma_3 c_3 (\sqrt{3} k_x + k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (k_x - \sqrt{3} k_y) + c_{i,2} k_z]; \\
T'; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z); \\
S'; \{R_6\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_z);
\end{aligned}$$

SG 155

 $\Gamma_{rh}; \{C_3^+|000\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \{R_3, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x (k_x^2 - 3k_y^2) + \{\sigma_+ [\alpha_1 k_y (k_y^2 - 3k_x^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\
R_6; & c_2 (\sigma_3 k_x + \sigma_1 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
Z; \{R_3, R_4\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + c_4 \sigma_3 k_x (k_x^2 - 3k_y^2) + \{\sigma_+ [\alpha_1 k_y (k_y^2 - 3k_x^2) + k_z (\alpha_2 + \alpha_3 k^2 + \alpha_4 k_z^2)] + h.c.\}; \\
R_6; & c_2 (\sigma_3 k_x + \sigma_1 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
L; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 (k_x - \sqrt{3} k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z]; \\
(a)F; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\
(b)F; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 (k_x + \sqrt{3} k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (\sqrt{3} k_x - k_y) + c_{i,2} k_z];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i - \sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\
&\quad \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
&P; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
&\quad \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i - \sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\
&\quad \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(i + \sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
&B; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + \sum_{i=1}^2 \sigma_i (c_{i,1} k_y + c_{i,2} k_z); \\
&Q; \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x + \sqrt{3} k_y)] + \sigma_3 c_3 (k_x + \sqrt{3} k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (\sqrt{3} k_x - k_y) + c_{i,2} k_z]; \\
&Y; \{R_2\}, \{R_4\}; \sigma_0 [c_1 + c_2 (k_x - \sqrt{3} k_y)] + \sigma_3 c_3 (k_x - \sqrt{3} k_y) + \sum_{i=1}^2 \sigma_i [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z];
\end{aligned}$$

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SG 156

$\Gamma_h; \{C_3^+ | 000\}, \{\sigma_{v1} | 000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$$\begin{aligned}
&\Gamma; \{R_3, R_4\}; c_2 \sigma_3 k_z + c_1 \sigma_0; \\
&\quad R_6; \quad c_2 (\sigma_3 k_x + \sigma_1 k_y) + c_1 \sigma_0; \\
&M; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_4 k_z) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_1 \sigma_0; \\
&A; \{R_3, R_4\}; c_2 \sigma_3 k_z + c_1 \sigma_0; \\
&\quad R_6; \quad c_2 (\sigma_3 k_x + \sigma_1 k_y) + c_1 \sigma_0; \\
&L; \{R_2, R_4\}; \sigma_3 (c_2 k_x + c_4 k_z) + (c_3 \sigma_1 - c_5 \sigma_2) k_y + c_1 \sigma_0; \\
&\Delta; R_6; \quad c_2 (\sigma_3 k_x + \sigma_1 k_y) + \sigma_0 (c_3 k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
&\quad \{R_3\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + [A_4 c_4 + (\sqrt{3} A_8 - A_5) c_5 - A_1 c_6] k_x - (A_6 c_4 - 2 A_7 c_5 - A_2 c_6) k_y; \\
&\quad \{R_4\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + [A_6 c_4 + (\sqrt{3} A_8 - A_5) c_5 - A_2 c_6] k_x + (A_4 c_4 + 2 A_7 c_5 - A_1 c_6) k_y; \\
&U; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x + c_3 k_z) + \sigma_3 (c_4 k_x + c_5 k_z) + (c_6 \sigma_1 + c_7 \sigma_2) k_y; \\
&P; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x + c_3 k_z) + \sigma_3 (c_4 k_x + c_5 k_z) + (c_6 \sigma_1 + c_7 \sigma_2) k_y; \\
&R; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x + c_3 k_z) + \sigma_3 (c_4 k_x + c_5 k_z) + (c_6 \sigma_1 + c_7 \sigma_2) k_y;
\end{aligned}$$

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 $\Gamma_h; \{C_3^+|000\}, \{\sigma_{d1}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \{R_3, R_4\}; & c_2\sigma_3k_z + c_1\sigma_0; \\
R_6; & c_2(\sigma_1k_x - \sigma_3k_y) + c_1\sigma_0; \\
M; \{R_2, R_4\}; & (c_2\sigma_1 - c_5\sigma_2)k_x + \sigma_3(c_3k_y + c_4k_z) + c_1\sigma_0; \\
A; \{R_3, R_4\}; & c_2\sigma_3k_z + c_1\sigma_0; \\
R_6; & c_2(\sigma_1k_x - \sigma_3k_y) + c_1\sigma_0; \\
L; \{R_2, R_4\}; & (c_2\sigma_1 - c_5\sigma_2)k_x + \sigma_3(c_3k_y + c_4k_z) + c_1\sigma_0; \\
K; R_6; & c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
H; R_6; & c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
\Delta; R_6; & c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
P; R_6; & c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_3\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
\{R_3\}, \{R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_6c_4 + 2A_7c_5 - A_2c_6)k_x + [A_4c_4 + (A_5 - \sqrt{3}A_8)c_5 - A_1c_6]k_y; \\
\{R_4\}, \{R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_4c_4 + 2A_7c_5 - A_1c_6)k_x - [A_6c_4 - (A_5 - \sqrt{3}A_8)c_5 - A_2c_6]k_y; \\
U; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y + c_3k_z) + \sigma_3(c_4k_y + c_5k_z) + (c_6\sigma_1 + c_7\sigma_2)k_x; \\
P; \{R_3\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
\{R_3\}, \{R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_6c_4 + 2A_7c_5 - A_2c_6)k_x + [A_4c_4 + (A_5 - \sqrt{3}A_8)c_5 - A_1c_6]k_y; \\
\{R_4\}, \{R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_4c_4 + 2A_7c_5 - A_1c_6)k_x - [A_6c_4 - (A_5 - \sqrt{3}A_8)c_5 - A_2c_6]k_y; \\
T; \{R_2\}, \{R_4\}; & \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y) + c_3k_z] + \sigma_3[c_4(\sqrt{3}k_x + k_y) + c_5k_z] + (c_6\sigma_1 + c_7\sigma_2)(k_x - \sqrt{3}k_y); \\
S; \{R_2\}, \{R_4\}; & \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y) + c_3k_z] + \sigma_3[c_4(\sqrt{3}k_x + k_y) + c_5k_z] + (c_6\sigma_1 + c_7\sigma_2)(k_x - \sqrt{3}k_y); \\
T'; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y + c_3k_z) + \sigma_3(c_4k_y + c_5k_z) + (c_6\sigma_1 + c_7\sigma_2)k_x; \\
S'; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y + c_3k_z) + \sigma_3(c_4k_y + c_5k_z) + (c_6\sigma_1 + c_7\sigma_2)k_x;
\end{aligned}$$

$\Gamma_h; \{C_3^+|000\}, \{\sigma_{v1}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
&\Gamma; \{R_3, R_4\}; c_2\sigma_3k_z + c_1\sigma_0; \\
&\quad R_6; c_2(\sigma_3k_x + \sigma_1k_y) + c_1\sigma_0; \\
&M; \{R_2, R_4\}; \sigma_3(c_2k_x + c_4k_z) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_1\sigma_0; \\
&A; \{R_1, R_1\}; c_1\sigma_0 + \sum_{i=1}^3 c_{i,1}k_z\sigma_i; \\
&\quad \{R_2, R_2\}; c_1\sigma_0 + \sum_{i=1}^3 c_{i,1}k_z\sigma_i; \\
&\quad \{R_5, R_5\}; c_1\Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}(\Gamma_{i,3}k_x - \Gamma_{i,1}k_y) + c_{i,2}\Gamma_{i,0}k_z]; \\
&L; \{R_1, R_1\}; c_1\sigma_0 + \sum_{i=1}^3 [c_{i,1}k_x + c_{i,2}k_z]\sigma_i; \\
&\quad \{R_3, R_3\}; c_1\sigma_0 + \sum_{i=1}^3 [c_{i,1}k_x + c_{i,2}k_z]\sigma_i; \\
&H; \{R_2, R_2\}; c_1\sigma_0 + \sum_{i=1}^3 c_{i,1}k_z\sigma_i; \\
&\quad \{R_4, R_4\}; c_1\sigma_0 + \sum_{i=1}^3 c_{i,1}k_z\sigma_i; \\
&\quad \{R_6, R_6\}; c_1\sigma_0 + \sum_{i=1}^3 c_{i,1}k_z\sigma_i; \\
&\Lambda; R_6; c_2(\sigma_3k_x + \sigma_1k_y) + \sigma_0(c_3k_z + c_1); \\
&S; \{R_2, R_2\}; [c_1 + c_2(\sqrt{3}k_x + k_y)]\sigma_0 + \sum_{i=1}^3 [c_{i,1}(k_x - \sqrt{3}k_y) + c_{i,2}k_z]\sigma_i; \\
&S'; \{R_2, R_2\}; (c_1 + c_2k_y)\sigma_0 + \sum_{i=1}^3 [c_{i,1}k_x + c_{i,2}k_z]\sigma_i;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
&\quad \{R_3\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + [A_4c_4 + (\sqrt{3}A_8 - A_5)c_5 - A_1c_6]k_x - (A_6c_4 - 2A_7c_5 - A_2c_6)k_y; \\
&\quad \{R_4\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + [A_6c_4 + (\sqrt{3}A_8 - A_5)c_5 - A_2c_6]k_x + (A_4c_4 + 2A_7c_5 - A_1c_6)k_y; \\
&U; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x + c_3k_z) + \sigma_3(c_4k_x + c_5k_z) + (c_6\sigma_1 + c_7\sigma_2)k_y; \\
&P; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4(\sigma_1k_y - \sigma_2k_x) + c_5(\sigma_1k_x + \sigma_2k_y); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4(\sigma_2k_x + \sigma_1k_y) + c_5(\sigma_1k_x - \sigma_2k_y); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4(\sigma_1k_y - \sigma_2k_x) + c_5(\sigma_1k_x + \sigma_2k_y); \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x + c_3k_z) + \sigma_3(c_4k_x + c_5k_z) + (c_6\sigma_1 + c_7\sigma_2)k_y; \\
&R; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x + c_3k_z) + \sigma_3(c_4k_x + c_5k_z) + (c_6\sigma_1 + c_7\sigma_2)k_y;
\end{aligned}$$



SG 159

 $\Gamma_h; \{C_3^+|000\}, \{\sigma_{d1}|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; & \{R_3, R_4\}; c_2\sigma_3k_z + c_1\sigma_0; \\
& R_6; c_2(\sigma_1k_x - \sigma_3k_y) + c_1\sigma_0; \\
M; & \{R_2, R_4\}; (c_2\sigma_1 - c_5\sigma_2)k_x + \sigma_3(c_3k_y + c_4k_z) + c_1\sigma_0; \\
A; & \{R_1, R_1\}; c_1\sigma_0 + \sum_{i=1}^3 c_{i,1}k_z\sigma_i; \\
& \{R_2, R_2\}; c_1\sigma_0 + \sum_{i=1}^3 c_{i,1}k_z\sigma_i; \\
& \{R_5, R_5\}; c_1\Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}(\Gamma_{i,1}k_x + \Gamma_{i,3}k_y) + c_{i,2}k_z\Gamma_{i,0}]; \\
L; & \{R_1, R_1\}; c_1\sigma_0 + \sum_{i=1}^3 [c_{i,1}k_y + c_{i,2}k_z]\sigma_i; \\
& \{R_3, R_3\}; c_1\sigma_0 + \sum_{i=1}^3 [c_{i,1}k_y + c_{i,2}k_z]\sigma_i; \\
K; & R_6; c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
H; & R_5; c_2(\sigma_1k_x + \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
\Lambda; & R_6; c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
P; & R_6; c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
R; & \{R_2, R_2\}; \sigma_0(c_2k_x + c_1) + \sum_{i=1}^3 [c_{i,1}k_y + c_{i,2}k_z];
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; & \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
& \{R_3\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_6c_4 + 2A_7c_5 - A_2c_6)k_x + [A_4c_4 + (A_5 - \sqrt{3}A_8)c_5 - A_1c_6]k_y; \\
& \{R_4\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_4c_4 + 2A_7c_5 - A_1c_6)k_x - [A_6c_4 - (A_5 - \sqrt{3}A_8)c_5 - A_2c_6]k_y; \\
U; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y + c_3k_z) + \sigma_3(c_4k_y + c_5k_z) + (c_6\sigma_1 + c_7\sigma_2)k_x; \\
P; & \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
& \{R_3\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_6c_4 + 2A_7c_5 - A_2c_6)k_x + [A_4c_4 + (A_5 - \sqrt{3}A_8)c_5 - A_1c_6]k_y; \\
& \{R_4\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_4c_4 + 2A_7c_5 - A_1c_6)k_x - [A_6c_4 - (A_5 - \sqrt{3}A_8)c_5 - A_2c_6]k_y; \\
T; & \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y) + c_3k_z] + \sigma_3[c_4(\sqrt{3}k_x + k_y) + c_5k_z] + (c_6\sigma_1 + c_7\sigma_2)(k_x - \sqrt{3}k_y); \\
S; & \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y) + c_3k_z] + \sigma_3[c_4(\sqrt{3}k_x + k_y) + c_5k_z] + (c_6\sigma_1 + c_7\sigma_2)(k_x - \sqrt{3}k_y); \\
T'; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y + c_3k_z) + \sigma_3(c_4k_y + c_5k_z) + (c_6\sigma_1 + c_7\sigma_2)k_x; \\
S'; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y + c_3k_z) + \sigma_3(c_4k_y + c_5k_z) + (c_6\sigma_1 + c_7\sigma_2)k_x;
\end{aligned}$$

SG 160

 $\Gamma_{rh}; \{C_3^+|000\}, \{\sigma_{d1}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; & \{R_3, R_4\}; c_2\sigma_3k_z + c_1\sigma_0; \\
& R_6; c_2(\sigma_1k_x - \sigma_3k_y) + c_1\sigma_0; \\
Z; & \{R_3, R_4\}; c_2\sigma_3k_z + c_1\sigma_0; \\
& R_6; c_2(\sigma_1k_x - \sigma_3k_y) + c_1\sigma_0; \\
L; & \{R_2, R_4\}; c_1\sigma_0 + \sigma_3[c_2(\sqrt{3}k_x + k_y) + c_3k_z] + \sum_{i=1}^2 c_{i,1}\sigma_i(k_x - \sqrt{3}k_y); \\
(a)F; & \{R_2, R_4\}; c_1\sigma_0 + \sigma_3(c_2k_y + c_3k_z) + \sum_{i=1}^2 c_{i,1}\sigma_i k_x; \\
(b)F; & \{R_2, R_4\}; c_1\sigma_0 + \sigma_3[c_2(\sqrt{3}k_x - k_y) + c_3k_z] + \sum_{i=1}^2 c_{i,1}\sigma_i(k_x + \sqrt{3}k_y); \\
\Lambda; & R_6; c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
P; & R_6; c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1);
\end{aligned}$$

$$\begin{aligned}
&\Lambda; \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
&\quad \{R_3\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + (A_6 c_4 + 2A_7 c_5 - A_2 c_6) k_x + [A_4 c_4 + (A_5 - \sqrt{3}A_8) c_5 - A_1 c_6] k_y; \\
&\quad \{R_4\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + (A_4 c_4 + 2A_7 c_5 - A_1 c_6) k_x - [A_6 c_4 - (A_5 - \sqrt{3}A_8) c_5 - A_2 c_6] k_y; \\
&P; \{R_3\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
&\quad \{R_3\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + (A_6 c_4 + 2A_7 c_5 - A_2 c_6) k_x + [A_4 c_4 + (A_5 - \sqrt{3}A_8) c_5 - A_1 c_6] k_y; \\
&\quad \{R_4\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3}A_5 + A_8) c_3 k_z + (A_4 c_4 + 2A_7 c_5 - A_1 c_6) k_x - [A_6 c_4 - (A_5 - \sqrt{3}A_8) c_5 - A_2 c_6] k_y;
\end{aligned}$$

## SG 161

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 $\Gamma_{rh}; \{C_3^+|000\}, \{\sigma_{d1}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 


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$$\begin{aligned}
\Gamma; & \{R_3, R_4\}; c_2\sigma_3k_z + c_1\sigma_0; \\
& R_6; c_2(\sigma_1k_x - \sigma_3k_y) + c_1\sigma_0; \\
Z; & \{R_1, R_1\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_2, R_2\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_5, R_5\}; c_1\Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}(\Gamma_{i,1}k_x + \Gamma_{i,3}k_y) + c_{i,2}\Gamma_{i,0}k_z]; \\
L; & \{R_1, R_1\}; c_1\sigma_0 + \sum_{i=1}^3 [c_{i,1}(\sqrt{3}k_x + k_y) + c_{i,2}k_z]\sigma_i; \\
& \{R_3, R_3\}; c_1\sigma_0 + \sum_{i=1}^3 [c_{i,1}(\sqrt{3}k_x + k_y) + c_{i,2}k_z]\sigma_i; \\
(a)F; & \{R_2, R_4\}; c_1\sigma_0 + \sigma_3(c_2k_y + c_3k_z) + \sum_{i=1}^2 c_{i,1}\sigma_i k_x; \\
(b)F; & \{R_2, R_4\}; c_1\sigma_0 + \sigma_3[c_2(\sqrt{3}k_x - k_y) + c_3k_z] + \sum_{i=1}^2 c_{i,1}\sigma_i(k_x + \sqrt{3}k_y); \\
\Lambda; & R_6; c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
P; & R_6; c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
B; & \{R_2, R_2\}; \sigma_0(c_2k_x + c_1) + \sum_{i=1}^3 \sigma_i(c_{i,1}k_y + c_{i,2}k_z); \\
Y; & \{R_2, R_2\}; [c_1 + c_2(k_x - \sqrt{3}k_y)]\sigma_0 + \sum_{i=1}^3 [c_{i,1}(\sqrt{3}k_x + k_y) + c_{i,2}k_z]\sigma_i;
\end{aligned}$$


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Accidental degeneracies on high symmetry line

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$$\begin{aligned}
\Lambda; & \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
& \{R_3\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_6c_4 + 2A_7c_5 - A_2c_6)k_x + [A_4c_4 + (A_5 - \sqrt{3}A_8)c_5 - A_1c_6]k_y; \\
& \{R_4\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_4c_4 + 2A_7c_5 - A_1c_6)k_x - [A_6c_4 - (A_5 - \sqrt{3}A_8)c_5 - A_2c_6]k_y; \\
P; & \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
& \{R_3\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_6c_4 + 2A_7c_5 - A_2c_6)k_x + [A_4c_4 + (A_5 - \sqrt{3}A_8)c_5 - A_1c_6]k_y; \\
& \{R_4\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_4c_4 + 2A_7c_5 - A_1c_6)k_x - [A_6c_4 - (A_5 - \sqrt{3}A_8)c_5 - A_2c_6]k_y;
\end{aligned}$$

## SG 162

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 $\Gamma_h; \{C_3^+|000\}, \{C_{21}'|000\}, \{I|000\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 


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Accidental degeneracies on high symmetry line

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$$\begin{aligned}
\Delta; & \{R_3, R_4\}, \{R_6\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{2,2}k_x - \Gamma_{1,0}k_y) + c_5(\Gamma_{2,1}k_x + \Gamma_{2,3}k_y); \\
P; & \{R_3, R_4\}, \{R_6\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{2,2}k_x - \Gamma_{1,0}k_y) + c_5(\Gamma_{2,1}k_x + \Gamma_{2,3}k_y);
\end{aligned}$$

## SG 163

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 $\Gamma_h; \{C_3^+|000\}, \{C_{21}'|00\frac{1}{2}\}, \{I|000\}, \mathcal{T}; \text{Centrosymmetric; with SOC}$ 


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$$\begin{aligned}
A; & \{R_{10}, R_{10}\}; (c_1 + c_2k^2 + c_3k_z^2)\Gamma_{0,0} + c_4\Gamma_{0,3}k_x(k_x^2 - 3k_y^2) + \sum_{i=1}^3 \Gamma_{i,2}[(c_{i,1} + c_{i,2}k^2 + c_{i,3}k_z^2)k_z + c_{i,4}k_y(k_y^2 - 3k_x^2)]; \\
& \{R_{17}, R_{18}\}; c_1\Gamma_{0,0} + c_2(\Gamma_{3,1}k_x + \Gamma_{0,2}k_y) + k_z(c_3\Gamma_{1,1} + c_4\Gamma_{2,1}); \\
L; & \{R_{10}, R_{10}\}; c_1\Gamma_{0,0} + c_2\Gamma_{0,2}k_x + \sum_{i=1}^3 \Gamma_{i,1}(c_{i,1}k_y + c_{i,2}k_z);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}\Delta; \{R_3, R_4\}, \{R_6\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,2} k_x - \Gamma_{1,0} k_y) + c_5 (\Gamma_{2,1} k_x + \Gamma_{2,3} k_y); \\ P; \{R_3, R_4\}, \{R_6\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,2} k_x - \Gamma_{1,0} k_y) + c_5 (\Gamma_{2,1} k_x + \Gamma_{2,3} k_y); \\ R; \{R_5, R_5\}, \{R_7, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_y + c_5 k_z) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1} k_y + c_{i,2} k_z); \end{aligned}$$

SG 164

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$\Gamma_h; \{C_3^+ | 000\}, \{C_{21}'' | 000\}, \{I | 000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

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Accidental degeneracies on high symmetry line

$$\begin{aligned}\Delta; \{R_3, R_4\}, \{R_6\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y) + c_5 (\Gamma_{2,1} k_y - \Gamma_{2,3} k_x); \\ P; \{R_2, R_6\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x) + (\alpha_1 \Gamma_{2,+} k_- + h.c.); \end{aligned}$$

SG 165

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$\Gamma_h; \{C_3^+ | 000\}, \{C_{21}'' | 00\frac{1}{2}\}, \{I | 000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$$\begin{aligned}A; \{R_{10}, R_{10}\}; & \quad (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + c_4 \Gamma_{0,3} k_y (k_y^2 - 3k_x^2) + \sum_{i=1}^3 \Gamma_{i,2} [(c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) k_z + c_{i,4} k_x (k_x^2 - 3k_y^2)]; \\ & \quad \{R_{17}, R_{18}\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_y - \Gamma_{0,2} k_x) + k_z (c_3 \Gamma_{1,1} + c_4 \Gamma_{2,1}); \\ L; \{R_{10}, R_{10}\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_y + \sum_{i=1}^3 \Gamma_{i,1} (c_{i,1} k_x + c_{i,2} k_z); \\ H; \{R_6, R_6\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,1} k_x - \Gamma_{0,3} k_y) + k_z (c_5 \Gamma_{1,2} + c_3 \Gamma_{2,2} + c_4 \Gamma_{3,2}); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}\Delta; \{R_3, R_4\}, \{R_6\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y) + c_5 (\Gamma_{2,1} k_y - \Gamma_{2,3} k_x); \\ P; \{R_2, R_6\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x) + (\alpha_1 \Gamma_{2,+} k_- + h.c.); \\ S; \{R_5, R_5\}, \{R_7, R_7\}; & \quad \Gamma_{0,0} [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \Gamma_{3,0} c_3 (\sqrt{3} k_x + k_y) + \Gamma_{1,0} [c_4 (k_x - \sqrt{3} k_y) + c_5 k_z] + \\ & \quad \sum_{i=1}^3 \Gamma_{2,i} [c_{i,1} (\sqrt{3} k_y - k_x) - c_{i,2} k_z]; \\ S'; \{R_5, R_5\}, \{R_7, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + \Gamma_{1,0} (c_4 k_x + c_5 k_z) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1} k_x + c_{i,2} k_z); \end{aligned}$$

SG 166

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$\Gamma_{rh}; \{C_3^+ | 000\}, \{C_{21}' | 000\}, \{I | 000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

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Accidental degeneracies on high symmetry line

$$\begin{aligned}\Lambda; \{R_3, R_4\}, \{R_6\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,2} k_x - \Gamma_{1,0} k_y) + c_5 (\Gamma_{2,1} k_x + \Gamma_{2,3} k_y); \\ P; \{R_3, R_4\}, \{R_6\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,2} k_x - \Gamma_{1,0} k_y) + c_5 (\Gamma_{2,1} k_x + \Gamma_{2,3} k_y); \end{aligned}$$

SG 167

 $\Gamma_{rh}; \{C_3^+|000\}, \{C'_{21}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
Z; \{R_{10}, R_{10}\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + c_4 \Gamma_{0,3} k_x (k_x^2 - 3k_y^2) + \sum_{i=1}^3 \Gamma_{i,2} [(c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) k_z + c_{i,4} k_y (k_y^2 - 3k_x^2)]; \\
\{R_{17}, R_{18}\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x + \Gamma_{0,2} k_y) + k_z (c_3 \Gamma_{1,1} + c_4 \Gamma_{2,1}); \\
L; \{R_{10}, R_{10}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} (k_x - \sqrt{3} k_y) + \sum_{i=1}^3 \Gamma_{i,1} [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z];
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,2} k_x - \Gamma_{1,0} k_y) + c_5 (\Gamma_{2,1} k_x + \Gamma_{2,3} k_y); \\
P; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,2} k_x - \Gamma_{1,0} k_y) + c_5 (\Gamma_{2,1} k_x + \Gamma_{2,3} k_y); \\
B; \{R_5, R_5\}, \{R_7, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + \Gamma_{1,0} (c_4 k_y + c_5 k_z) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1} k_y + c_{i,2} k_z); \\
Y; \{R_5, R_5\}, \{R_7, R_7\}; & \Gamma_{0,0} [c_1 + c_2 (k_x - \sqrt{3} k_y)] + \Gamma_{3,0} c_3 (k_x - \sqrt{3} k_y) + \Gamma_{1,0} [c_4 (\sqrt{3} k_x + k_y) + c_5 k_z] + \\
& \sum_{i=1}^3 \Gamma_{2,i} [c_{i,1} (\sqrt{3} k_x + k_y) + c_{i,2} k_z];
\end{aligned}$$

SG 168

 $\Gamma_h; \{C_6^+|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \{R_2, R_{12}\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_4, R_{10}\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(\alpha_1 k_-^3 + \alpha_2 k_+^3) \sigma_+ + h.c.]; \\
\{R_6, R_8\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
M; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
A; \{R_2, R_{12}\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
\{R_4, R_{10}\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(\alpha_1 k_-^3 + \alpha_2 k_+^3) \sigma_+ + h.c.]; \\
\{R_6, R_8\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
L; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
K; \{R_2, R_6\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
H; \{R_2, R_6\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.);
\end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_{10}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_+^2 + h.c.); \\
&\{R_2\}, \{R_{12}\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_+\sigma_+ + h.c.); \\
&\{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
&\{R_2\}, \{R_6\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
&\{R_2\}, \{R_8\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
&\{R_4\}, \{R_{10}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
&\{R_4\}, \{R_{12}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_+^2 + h.c.); \\
&\{R_4\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
&\{R_4\}, \{R_8\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
&\{R_6\}, \{R_{10}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
&\{R_6\}, \{R_{12}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
&\{R_6\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
&\{R_8\}, \{R_{10}\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
&\{R_8\}, \{R_{12}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
&\{R_{10}\}, \{R_{12}\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
U; \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\
P; \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_1k_y - \sigma_2k_x) + c_5 (\sigma_1k_x + \sigma_2k_y); \\
\{R_2\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_2k_x + \sigma_1k_y) + c_5 (\sigma_1k_x - \sigma_2k_y); \\
\{R_4\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_1k_y - \sigma_2k_x) + c_5 (\sigma_1k_x + \sigma_2k_y);
\end{aligned}$$

SG 169

 $\Gamma_h; \{C_6^+ | 00\frac{1}{6}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \{R_2, R_{12}\}; \quad &c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
\{R_4, R_{10}\}; \quad &(c_1 + c_2k^2 + c_3k_z^2)\sigma_0 + (c_4 + c_5k^2 + c_6k_z^2)k_z\sigma_3 + [(\alpha_1k_-^3 + \alpha_2k_+^3)\sigma_+ + h.c.]; \\
\{R_6, R_8\}; \quad &c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
M; \{R_2, R_4\}; \quad &c_1\sigma_0 + c_2\sigma_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\
A; \{R_1, R_1\}; \quad &(c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
\{R_3, R_{11}\}; \quad &c_2\sigma_3k_z + c_1\sigma_0; \\
\{R_5, R_9\}; \quad &c_2\sigma_3k_z + c_1\sigma_0; \\
\{R_7, R_7\}; \quad &(c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
L; \{R_1, R_1\}; \quad &(c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
\{R_3, R_3\}; \quad &(c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
K; \{R_2, R_6\}; \quad &c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
H; \{R_2, R_6\}; \quad &c_2\sigma_3k_z + c_1\sigma_0; \\
\{R_4, R_4\}; \quad &(c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
S; \{R_2, R_2\}; \quad &\sigma_0 (c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{1,i}\sigma_i k_z; \\
S'; \{R_2, R_2\}; \quad &\sigma_0 (c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{1,i}\sigma_i k_z; \\
R; \{R_2, R_2\}; \quad &\sigma_0 (c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{1,i}\sigma_i k_z;
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_{10}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_+^2 + h.c.); \\
&\{R_2\}, \{R_{12}\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_+\sigma_+ + h.c.); \\
&\{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
&\{R_2\}, \{R_6\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
&\{R_2\}, \{R_8\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
&\{R_4\}, \{R_{10}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
&\{R_4\}, \{R_{12}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_+^2 + h.c.); \\
&\{R_4\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
&\{R_4\}, \{R_8\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
&\{R_6\}, \{R_{10}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
&\{R_6\}, \{R_{12}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
&\{R_6\}, \{R_8\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
&\{R_8\}, \{R_{10}\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
&\{R_8\}, \{R_{12}\}; \quad c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
&\{R_{10}\}, \{R_{12}\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
U; \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\
P; \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_1k_y - \sigma_2k_x) + c_5 (\sigma_1k_x + \sigma_2k_y); \\
\{R_2\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_2k_x + \sigma_1k_y) + c_5 (\sigma_1k_x - \sigma_2k_y); \\
\{R_4\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_1k_y - \sigma_2k_x) + c_5 (\sigma_1k_x + \sigma_2k_y);
\end{aligned}$$

SG 170

 $\Gamma_h; \{C_6^+ | 00\frac{5}{6}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \{R_2, R_{12}\}; \quad c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
\{R_4, R_{10}\}; \quad (c_1 + c_2k^2 + c_3k_z^2)\sigma_0 + (c_4 + c_5k^2 + c_6k_z^2)k_z\sigma_3 + [(\alpha_1k_-^3 + \alpha_2k_+^3)\sigma_+ + h.c.]; \\
\{R_6, R_8\}; \quad c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
M; \{R_2, R_4\}; \quad c_1\sigma_0 + c_2\sigma_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\
A; \{R_1, R_1\}; \quad (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
\{R_3, R_{11}\}; \quad c_2\sigma_3k_z + c_1\sigma_0; \\
\{R_5, R_9\}; \quad c_2\sigma_3k_z + c_1\sigma_0; \\
\{R_7, R_7\}; \quad (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
L; \{R_1, R_1\}; \quad (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
\{R_3, R_3\}; \quad (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
K; \{R_2, R_6\}; \quad c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
H; \{R_2, R_6\}; \quad c_2\sigma_3k_z + c_1\sigma_0; \\
\{R_4, R_4\}; \quad (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
S; \{R_2, R_2\}; \quad \sigma_0 (c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{1,i}\sigma_i k_z; \\
S'; \{R_2, R_2\}; \quad \sigma_0 (c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{1,i}\sigma_i k_z; \\
R; \{R_2, R_2\}; \quad \sigma_0 (c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{1,i}\sigma_i k_z;
\end{aligned}$$

$$\begin{aligned}
\Delta; \{R_2\}, \{R_{10}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_2\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_+\sigma_+ + h.c.); \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
\{R_2\}, \{R_6\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
\{R_2\}, \{R_8\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
\{R_4\}, \{R_{10}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
\{R_4\}, \{R_{12}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_+^2 + h.c.); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
\{R_4\}, \{R_8\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
\{R_6\}, \{R_{10}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
\{R_6\}, \{R_{12}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
\{R_8\}, \{R_{10}\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
\{R_8\}, \{R_{12}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
\{R_{10}\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\
P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_1k_y - \sigma_2k_x) + c_5 (\sigma_1k_x + \sigma_2k_y); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_2k_x + \sigma_1k_y) + c_5 (\sigma_1k_x - \sigma_2k_y); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_1k_y - \sigma_2k_x) + c_5 (\sigma_1k_x + \sigma_2k_y);
\end{aligned}$$



SG 171

 $\Gamma_h; \{C_6^+ | 00 \frac{1}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \{R_2, R_{12}\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
& \{R_4, R_{10}\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(\alpha_1 k_-^3 + \alpha_2 k_+^3) \sigma_+ + h.c.]; \\
& \{R_6, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
M; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
A; \{R_2, R_{12}\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
& \{R_4, R_{10}\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(\alpha_1 k_-^3 + \alpha_2 k_+^3) \sigma_+ + h.c.]; \\
& \{R_6, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
L; \{R_2, R_4\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
K; \{R_2, R_6\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
H; \{R_2, R_6\}; & c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_{10}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
& \{R_2\}, \{R_{12}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
& \{R_2\}, \{R_6\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
& \{R_2\}, \{R_8\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
& \{R_4\}, \{R_{10}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
& \{R_4\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
& \{R_4\}, \{R_8\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
& \{R_6\}, \{R_{10}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
& \{R_6\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
& \{R_8\}, \{R_{10}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
& \{R_8\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
& \{R_{10}\}, \{R_{12}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
& \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y);
\end{aligned}$$

$\Gamma_h; \{C_6^+ | 00 \frac{2}{3}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
 &\Gamma; \{R_2, R_{12}\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
 &\quad \{R_4, R_{10}\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(\alpha_1 k_-^3 + \alpha_2 k_+^3) \sigma_+ + h.c.]; \\
 &\quad \{R_6, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
 &M; \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
 &A; \{R_2, R_{12}\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
 &\quad \{R_4, R_{10}\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(\alpha_1 k_-^3 + \alpha_2 k_+^3) \sigma_+ + h.c.]; \\
 &\quad \{R_6, R_8\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.); \\
 &L; \{R_2, R_4\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
 &K; \{R_2, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_+ + h.c.); \\
 &H; \{R_2, R_6\}; c_1 \sigma_0 + c_2 \sigma_3 k_z + (\alpha_1 \sigma_+ k_- + h.c.);
 \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
 &\Delta; \{R_2\}, \{R_{10}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
 &\quad \{R_2\}, \{R_{12}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_+ \sigma_+ + h.c.); \\
 &\quad \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
 &\quad \{R_2\}, \{R_6\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
 &\quad \{R_2\}, \{R_8\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
 &\quad \{R_4\}, \{R_{10}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
 &\quad \{R_4\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_+^2 + h.c.); \\
 &\quad \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
 &\quad \{R_4\}, \{R_8\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
 &\quad \{R_6\}, \{R_{10}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
 &\quad \{R_6\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(\alpha_1 k_+^3 + \alpha_2 k_-^3) \sigma_+ + h.c.]; \\
 &\quad \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
 &\quad \{R_8\}, \{R_{10}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
 &\quad \{R_8\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + (\alpha_1 \sigma_+ k_-^2 + h.c.); \\
 &\quad \{R_{10}\}, \{R_{12}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (\alpha_1 k_- \sigma_+ + h.c.); \\
 &U; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
 &P; \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
 &\quad \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
 &\quad \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y);
 \end{aligned}$$

$$\begin{aligned}
\Gamma; & \{R_2, R_{12}\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
& \{R_4, R_{10}\}; (c_1 + c_2k^2 + c_3k_z^2)\sigma_0 + (c_4 + c_5k^2 + c_6k_z^2)k_z\sigma_3 + [(\alpha_1k_+^3 + \alpha_2k_+^3)\sigma_+ + h.c.]; \\
& \{R_6, R_8\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_- + h.c.); \\
M; & \{R_2, R_4\}; c_1\sigma_0 + c_2\sigma_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\
A; & \{R_1, R_1\}; \sum_{i=1}^3 c_{1,i}\sigma_i k_z + c_1\sigma_0; \\
& \{R_3, R_{11}\}; c_2\sigma_3k_z + c_1\sigma_0; \\
& \{R_5, R_9\}; c_2\sigma_3k_z + c_1\sigma_0; \\
& \{R_7, R_7\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
L; & \{R_1, R_1\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
& \{R_3, R_3\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
K; & \{R_2, R_6\}; c_1\sigma_0 + c_2\sigma_3k_z + (\alpha_1\sigma_+k_+ + h.c.); \\
H; & \{R_2, R_6\}; c_2\sigma_3k_z + c_1\sigma_0; \\
& \{R_4, R_4\}; (c_3\sigma_1 - c_4\sigma_2 + c_2\sigma_3)k_z + c_1\sigma_0; \\
S; & \{R_2, R_2\}; \sigma_0 (c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{1,i}\sigma_i k_z; \\
S'; & \{R_2, R_2\}; \sigma_0 (c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{1,i}\sigma_i k_z; \\
R; & \{R_2, R_2\}; \sigma_0 (c_2k_x + c_3k_y + c_1) + \sum_{i=1}^3 c_{1,i}\sigma_i k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; & \{R_2\}, \{R_{10}\}; c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_+^2 + h.c.); \\
& \{R_2\}, \{R_{12}\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_+\sigma_+ + h.c.); \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
& \{R_2\}, \{R_6\}; c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
& \{R_2\}, \{R_8\}; c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
& \{R_4\}, \{R_{10}\}; c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
& \{R_4\}, \{R_{12}\}; c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_+^2 + h.c.); \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
& \{R_4\}, \{R_8\}; c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
& \{R_6\}, \{R_{10}\}; c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
& \{R_6\}, \{R_{12}\}; c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(\alpha_1k_+^3 + \alpha_2k_-^3)\sigma_+ + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
& \{R_8\}, \{R_{10}\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
& \{R_8\}, \{R_{12}\}; c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + (\alpha_1\sigma_+k_-^2 + h.c.); \\
& \{R_{10}\}, \{R_{12}\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + (\alpha_1k_-\sigma_+ + h.c.); \\
U; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + \sum_{i=1}^2 \sigma_i (c_{i,1}k_x + c_{i,2}k_y); \\
P; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_1k_y - \sigma_2k_x) + c_5 (\sigma_1k_x + \sigma_2k_y); \\
& \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_2k_x + \sigma_1k_y) + c_5 (\sigma_1k_x - \sigma_2k_y); \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 (\sigma_1k_y - \sigma_2k_x) + c_5 (\sigma_1k_x + \sigma_2k_y);
\end{aligned}$$

SG 174

 $\Gamma_h; \{S_3^+|000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \{R_2, R_{12}\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sigma_3 [c_4 (k_x^3 - 3k_x k_y^2) + c_5 k_y (k_y^2 - 3k_x^2)] + (\alpha_1 \sigma_+ k_+^2 k_z + h.c.); \\
& \{R_4, R_{10}\}; (c_2 \sigma_1 + c_3 \sigma_2) k_z + c_1 \sigma_0; \\
& \{R_6, R_8\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sigma_3 [c_4 (k_x^3 - 3k_x k_y^2) + c_5 k_y (k_y^2 - 3k_x^2)] + (\alpha_1 \sigma_+ k_+^2 k_z + h.c.); \\
M; \{R_2, R_4\}; & \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 + c_5 \sigma_2) k_z + c_1 \sigma_0; \\
A; \{R_2, R_{12}\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sigma_3 [c_4 (k_x^3 - 3k_x k_y^2) + c_5 k_y (k_y^2 - 3k_x^2)] + (\alpha_1 \sigma_+ k_+^2 k_z + h.c.); \\
& \{R_4, R_{10}\}; (c_2 \sigma_1 + c_3 \sigma_2) k_z + c_1 \sigma_0; \\
& \{R_6, R_8\}; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + \sigma_3 [c_4 (k_x^3 - 3k_x k_y^2) + c_5 k_y (k_y^2 - 3k_x^2)] + (\alpha_1 \sigma_+ k_+^2 k_z + h.c.); \\
L; \{R_2, R_4\}; & \sigma_3 (c_2 k_x + c_3 k_y) + (c_4 \sigma_1 + c_5 \sigma_2) k_z + c_1 \sigma_0; \\
\Delta; \{R_2, R_6\}; & (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) \sigma_0 + (\alpha_1 \sigma_+ k_+^2 + h.c.);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2, R_6\}, \{R_4\}; & A_0 (c_1 + c_2 k_z) + A_8 c_3 k_z + [c_4 (A_3 - 2A_2 + \sqrt{3}A_7) + c_5 (A_2 - 2A_3 + \sqrt{3}A_6)] k_x + \\
& [c_4 (2A_6 + A_7 - \sqrt{3}A_3) - c_5 (A_6 + 2A_7 + \sqrt{3}A_2)] k_y; \\
P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
& \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_2 k_x + \sigma_1 k_y) + c_5 (\sigma_1 k_x - \sigma_2 k_y); \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 (\sigma_1 k_y - \sigma_2 k_x) + c_5 (\sigma_1 k_x + \sigma_2 k_y); \\
T; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + (c_6 \sigma_1 + c_7 \sigma_2) k_z; \\
S; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + (c_6 \sigma_1 + c_7 \sigma_2) k_z; \\
T'; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + (c_6 \sigma_1 + c_7 \sigma_2) k_z; \\
S'; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + (c_6 \sigma_1 + c_7 \sigma_2) k_z; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + (c_6 \sigma_1 + c_7 \sigma_2) k_z; \\
R; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_3 k_y) + \sigma_3 (c_4 k_x + c_5 k_y) + (c_6 \sigma_1 + c_7 \sigma_2) k_z;
\end{aligned}$$

SG 175

 $\Gamma_h; \{C_6^+|000\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2, R_{12}\}, \{R_4, R_{10}\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x); \\
& \{R_2, R_{12}\}, \{R_6, R_8\}; c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + \Gamma_{1,0} [2c_2 k_x k_y + c_3 (k_x^2 - k_y^2)] + \Gamma_{2,3} [c_2 (k_y^2 - k_x^2) + 2c_3 k_x k_y]; \\
& \{R_4, R_{10}\}, \{R_6, R_8\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x); \\
P; \{R_2, R_6\}, \{R_4, R_4\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x) + (\alpha_1 \Gamma_{2,+} k_- + h.c.);
\end{aligned}$$

SG 176

 $\Gamma_h; \{C_6^+|00\frac{1}{2}\}, \{I|00\frac{1}{2}\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$$\begin{aligned}
A; \{R_{28}, R_{30}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{3,3} k_z; \\
& \{R_{29}, R_{29}\}; c_1 \Gamma_{0,0} + k_z (c_3 \Gamma_{1,3} - c_4 \Gamma_{2,3} + c_2 \Gamma_{3,3}); \\
L; \{R_{10}, R_{10}\}; & c_1 \Gamma_{0,0} + \Gamma_{0,2} (c_2 k_x + c_3 k_y) + \sum_{i=1}^3 c_{i,1} \Gamma_{i,1} k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2, R_{12}\}, \{R_4, R_{10}\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x); \\
&\quad \{R_2, R_{12}\}, \{R_6, R_8\}; \quad c_1 \Gamma_{0,0} + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + \Gamma_{1,0} [2c_2 k_x k_y + c_3 (k_x^2 - k_y^2)] + \Gamma_{2,3} [c_2 (k_y^2 - k_x^2) + 2c_3 k_x k_y]; \\
&\quad \{R_4, R_{10}\}, \{R_6, R_8\}; \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x); \\
&P; \{R_2, R_6\}, \{R_4, R_4\}; \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \Gamma_{2,3} (c_4 k_y - c_5 k_x) + (\alpha_1 \Gamma_{2,+} k_- + h.c.); \\
&S; \{R_2, R_2\}, \{R_4, R_4\}; \quad \Gamma_{0,0} (c_1 + c_2 k_x + c_3 k_y) + \Gamma_{3,0} (c_4 k_x + c_5 k_y) + k_z (c_6 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,1} \Gamma_{2,i}); \\
&S'; \{R_2, R_2\}, \{R_4, R_4\}; \quad \Gamma_{0,0} (c_1 + c_2 k_x + c_3 k_y) + \Gamma_{3,0} (c_4 k_x + c_5 k_y) + k_z (c_6 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,1} \Gamma_{2,i}); \\
&R; \{R_2, R_2\}, \{R_4, R_4\}; \quad \Gamma_{0,0} (c_1 + c_2 k_x + c_3 k_y) + \Gamma_{3,0} (c_4 k_x + c_5 k_y) + k_z (c_6 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,1} \Gamma_{2,i});
\end{aligned}$$

SG 177

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 $\Gamma_h; \{C_6^+ | 000\}, \{C_{21}' | 000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
&\Gamma; \quad R_7; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(c_7 k_+^3 + c_8 k_-^3) \sigma_+ + h.c.]; \\
&\quad R_8; c_2 (\sigma_1 k_x - \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
&\quad R_9; c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
&M; \quad R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
&A; \quad R_7; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(c_7 k_+^3 + c_8 k_-^3) \sigma_+ + h.c.]; \\
&\quad R_8; c_2 (\sigma_1 k_x - \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
&\quad R_9; c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
&L; \quad R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
&K; \quad R_6; c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_3 \sigma_2 k_z + c_1 \sigma_0; \\
&H; \quad R_6; c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_3 \sigma_2 k_z + c_1 \sigma_0;
\end{aligned}$$

$$\begin{aligned}
\Delta; \{R_2\}, \{R_{10}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + [(1+i\sqrt{3})c_2\sigma_+k_+^2 + h.c.]; \\
\{R_2\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + [(1-i\sqrt{3})c_4\sigma_+k_+ + h.c.]; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + [(1+i\sqrt{3})c_4\sigma_+k_- + h.c.]; \\
\{R_2\}, \{R_6\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + [(1-i\sqrt{3})c_2\sigma_+k_-^2 + h.c.]; \\
\{R_2\}, \{R_8\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(c_2k_+^3 + c_3k_-^3)\sigma_+ + h.c.]; \\
\{R_4\}, \{R_{10}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(c_2k_+^3 + c_3k_-^3)\sigma_+ + h.c.]; \\
\{R_4\}, \{R_{12}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + [(1+i\sqrt{3})c_2\sigma_+k_+^2 + h.c.]; \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + [(1+i\sqrt{3})c_4\sigma_+k_- + h.c.]; \\
\{R_4\}, \{R_8\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + [(1-i\sqrt{3})c_2\sigma_+k_-^2 + h.c.]; \\
\{R_6\}, \{R_{10}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + [(1-i\sqrt{3})c_2\sigma_+k_-^2 + h.c.]; \\
\{R_6\}, \{R_{12}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1}k_z (1 + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}k^2 + c_{i,5}k_z^2] + [(c_2k_+^3 + c_3k_-^3)\sigma_+ + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + [(1+i\sqrt{3})c_4\sigma_+k_- + h.c.]; \\
\{R_8\}, \{R_{10}\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + [(1+i\sqrt{3})c_4\sigma_+k_- + h.c.]; \\
\{R_8\}, \{R_{12}\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + [(1-i\sqrt{3})c_2\sigma_+k_-^2 + h.c.]; \\
\{R_{10}\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + [(1+i\sqrt{3})c_4\sigma_+k_- + h.c.]; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1k_x + c_5\sigma_2k_y; \\
P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) - \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2k_z) + \sigma_3c_3k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
T; \{R_2\}, \{R_4\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3}k_x + k_y) + c_2\sigma_2 (\sqrt{3}k_y - k_x) + c_3\sigma_1k_z; \\
S; \{R_2\}, \{R_4\}; & c_1\sigma_0 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3}k_x + k_y) + c_2\sigma_2 (\sqrt{3}k_y - k_x) + c_3\sigma_1k_z; \\
T'; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x + c_5\sigma_2k_z; \\
S'; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_1k_x + c_5\sigma_2k_z; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y + c_5\sigma_1k_z; \\
R; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_y + c_5\sigma_1k_z;
\end{aligned}$$

$\Gamma_h; \{C_6^+ | 00\frac{1}{6}\}, \{C_{21}' | 000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_7; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(c_7 k_+^3 + c_8 k_-^3) \sigma_+ + h.c.]; \\
R_8; & c_2 (\sigma_1 k_x - \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
R_9; & c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
M; R_5; & c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
A; \{R_{10}, R_{11}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\{R_{12}, R_{13}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
R_{14}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
R_{15}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
L; \{R_5, R_6\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\{R_7, R_8\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
K; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_3 \sigma_2 k_z + c_1 \sigma_0; \\
H; \{R_3, R_4\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
R_6; & c_1 \sigma_0 - c_2 \sigma_2 k_z; \\
S; \{R_{17}, R_{23}\}; & \sigma_0 \left[ c_2 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + c_1 \right] + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
S'; \{R_5, R_7\}; & \sigma_0 (c_2 k_y + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
R; \{R_2, R_4\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_{10}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
\{R_2\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 - i\sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_2\}, \{R_6\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_2\}, \{R_8\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
\{R_4\}, \{R_{10}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
\{R_4\}, \{R_{12}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_4\}, \{R_8\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_6\}, \{R_{10}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_6\}, \{R_{12}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_8\}, \{R_{10}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_8\}, \{R_{12}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_{10}\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y; \\
P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) - \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
T; \{R_2\}, \{R_4\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3} k_x + k_y) + c_2 \sigma_2 (\sqrt{3} k_y - k_x) + c_3 \sigma_1 k_z; \\
T'; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z;
\end{aligned}$$

$\Gamma_h; \{C_6^+ | 00 \frac{5}{6}\}, \{C_{21}' | 000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$$\begin{aligned}
 \Gamma; R_7; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(c_7 k_+^3 + c_8 k_-^3) \sigma_+ + h.c.]; \\
 R_8; & c_2 (\sigma_1 k_x - \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
 R_9; & c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
 M; R_5; & c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
 A; \{R_{10}, R_{11}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
 \{R_{12}, R_{13}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
 R_{14}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
 R_{15}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
 L; \{R_5, R_6\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
 \{R_7, R_8\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
 K; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_3 \sigma_2 k_z + c_1 \sigma_0; \\
 H; \{R_3, R_4\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
 R_6; & c_1 \sigma_0 - c_2 \sigma_2 k_z; \\
 S; \{R_{15}, R_{21}\}; & \sigma_0 \left[ c_2 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + c_1 \right] + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
 S'; \{R_5, R_7\}; & \sigma_0 (c_2 k_y + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
 R; \{R_2, R_4\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z;
 \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Delta; \{R_2\}, \{R_{10}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
 \{R_2\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 - i\sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\
 \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
 \{R_2\}, \{R_6\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
 \{R_2\}, \{R_8\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
 \{R_4\}, \{R_{10}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
 \{R_4\}, \{R_{12}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
 \{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
 \{R_4\}, \{R_8\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
 \{R_6\}, \{R_{10}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
 \{R_6\}, \{R_{12}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
 \{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
 \{R_8\}, \{R_{10}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
 \{R_8\}, \{R_{12}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
 \{R_{10}\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
 U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y; \\
 P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
 \{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) - \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
 \{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
 T; \{R_2\}, \{R_4\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3} k_x + k_y) + c_2 \sigma_2 (\sqrt{3} k_y - k_x) + c_3 \sigma_1 k_z; \\
 T'; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
 \Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z;
 \end{aligned}$$



$\Gamma_h; \{C_6^+|00\frac{1}{3}\}, \{C_{21}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; & R_7; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(c_7 k_+^3 + c_8 k_-^3) \sigma_+ + h.c.]; \\
& R_8; c_2 (\sigma_1 k_x - \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& R_9; c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
M; & R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y + c_4 \sigma_2 k_z + c_1 \sigma_0; \\
A; & R_7; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(c_7 k_+^3 + c_8 k_-^3) \sigma_+ + h.c.]; \\
& R_8; c_2 (\sigma_1 k_x - \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& R_9; c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
L; & R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y + c_4 \sigma_2 k_z + c_1 \sigma_0; \\
K; & R_6; c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
H; & R_6; c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; & \{R_2\}, \{R_{10}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
& \{R_2\}, \{R_{12}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 - i\sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
& \{R_2\}, \{R_6\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
& \{R_2\}, \{R_8\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
& \{R_4\}, \{R_{10}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
& \{R_4\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
& \{R_4\}, \{R_8\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
& \{R_6\}, \{R_{10}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
& \{R_6\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
& \{R_8\}, \{R_{10}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
& \{R_8\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
& \{R_{10}\}, \{R_{12}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
U; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y; \\
P; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
& \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) - \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
T; & \{R_2\}, \{R_4\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3} k_x + k_y) + c_2 \sigma_2 (\sqrt{3} k_y - k_x) + c_3 \sigma_1 k_z; \\
S; & \{R_6\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3} k_x + k_y) + c_2 \sigma_2 (\sqrt{3} k_y - k_x) + c_3 \sigma_1 k_z; \\
T'; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
S'; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Sigma; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
R; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z;
\end{aligned}$$

SG 181

 $\Gamma_h; \{C_6^+|00\frac{2}{3}\}, \{C_{21}'|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; & R_7; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(c_7 k_+^3 + c_8 k_-^3) \sigma_+ + h.c.]; \\
& R_8; c_2 (\sigma_1 k_x - \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& R_9; c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
M; & R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
A; & R_7; (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(c_7 k_+^3 + c_8 k_-^3) \sigma_+ + h.c.]; \\
& R_8; c_2 (\sigma_1 k_x - \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
& R_9; c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
L; & R_5; c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
K; & R_6; c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
H; & R_6; c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; & \{R_2\}, \{R_{10}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
& \{R_2\}, \{R_{12}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 - i\sqrt{3}) c_4 \sigma_+ k_+ + h.c.]; \\
& \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
& \{R_2\}, \{R_6\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
& \{R_2\}, \{R_8\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
& \{R_4\}, \{R_{10}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
& \{R_4\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
& \{R_4\}, \{R_8\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
& \{R_6\}, \{R_{10}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
& \{R_6\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
& \{R_6\}, \{R_8\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
& \{R_8\}, \{R_{10}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
& \{R_8\}, \{R_{12}\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
& \{R_{10}\}, \{R_{12}\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
U; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y; \\
P; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
& \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) - \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
& \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
T; & \{R_2\}, \{R_4\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3} k_x + k_y) + c_2 \sigma_2 (\sqrt{3} k_y - k_x) + c_3 \sigma_1 k_z; \\
S; & \{R_2\}, \{R_8\}; c_1 \sigma_0 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3} k_x + k_y) + c_2 \sigma_2 (\sqrt{3} k_y - k_x) + c_3 \sigma_1 k_z; \\
T'; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
S'; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Sigma; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z; \\
R; & \{R_2\}, \{R_4\}; \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z;
\end{aligned}$$

$\Gamma_h; \{C_6^+ | 00\frac{1}{2}\}, \{C_{21}^+ | 000\}, \mathcal{T}$ ; Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_7; & (c_1 + c_2 k^2 + c_3 k_z^2) \sigma_0 + (c_4 + c_5 k^2 + c_6 k_z^2) k_z \sigma_3 + [(c_7 k_+^3 + c_8 k_-^3) \sigma_+ + h.c.]; \\
R_8; & c_2 (\sigma_1 k_x - \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
R_9; & c_2 (\sigma_1 k_x + \sigma_2 k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
M; R_5; & c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
A; \{R_{10}, R_{11}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\{R_{12}, R_{13}\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
R_{14}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
R_{15}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
L; \{R_5, R_6\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
\{R_7, R_8\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
K; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
H; \{R_3, R_4\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_z + c_1 \sigma_0; \\
R_6; & c_1 \sigma_0 - c_2 \sigma_2 k_z; \\
S; \{R_5, R_7\}; & \sigma_0 \left[ c_2 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + c_1 \right] + c_3 \sigma_1 k_z - c_4 \sigma_2 k_z; \\
S'; \{R_5, R_7\}; & \sigma_0 (c_2 k_y + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z; \\
R; \{R_2, R_4\}; & \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_{10}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
\{R_2\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 - i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_2\}, \{R_6\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_2\}, \{R_8\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
\{R_4\}, \{R_{10}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
\{R_4\}, \{R_{12}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 + i\sqrt{3}) c_2 \sigma_+ k_+^2 + h.c.]; \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_4\}, \{R_8\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_6\}, \{R_{10}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_6\}, \{R_{12}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i [c_{i,1} k_z (1 + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} k^2 + c_{i,5} k_z^2] + [(c_2 k_+^3 + c_3 k_-^3) \sigma_+ + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_8\}, \{R_{10}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
\{R_8\}, \{R_{12}\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + [(1 - i\sqrt{3}) c_2 \sigma_+ k_-^2 + h.c.]; \\
\{R_{10}\}, \{R_{12}\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + [(1 + i\sqrt{3}) c_4 \sigma_+ k_- + h.c.]; \\
U; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 k_x + c_5 \sigma_2 k_y; \\
P; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) - \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \left[ \sigma_1 \left( k_x + \frac{k_y}{\sqrt{3}} \right) + \sigma_2 \left( k_y - \frac{k_x}{\sqrt{3}} \right) \right]; \\
T; \{R_2\}, \{R_4\}; & c_1 \sigma_0 + \sum_{i=0,3} \sigma_i c_{i,1} (\sqrt{3} k_x + k_y) + c_2 \sigma_2 (\sqrt{3} k_y - k_x) + c_3 \sigma_1 k_z; \\
T'; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_2 k_y + c_5 \sigma_1 k_z;
\end{aligned}$$

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 $\Gamma_h; \{C_6^+|000\}, \{\sigma_{d1}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
&\Gamma; R_7; c_1\sigma_0; \\
&\quad R_8; c_2(\sigma_2k_x + \sigma_1k_y) + c_1\sigma_0; \\
&\quad R_9; c_2(\sigma_1k_y - \sigma_2k_x) + c_1\sigma_0; \\
&M; R_5; c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
&A; R_7; c_1\sigma_0; \\
&\quad R_8; c_2(\sigma_2k_x + \sigma_1k_y) + c_1\sigma_0; \\
&\quad R_9; c_2(\sigma_1k_y - \sigma_2k_x) + c_1\sigma_0; \\
&L; R_5; c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
&K; R_6; c_2(\sigma_1k_x - \sigma_3k_y) + c_1\sigma_0; \\
&H; R_6; c_2(\sigma_1k_x - \sigma_3k_y) + c_1\sigma_0; \\
&\Delta; R_7; (c_1 + c_2k_z + c_3k^2 + c_4k_z^2 + c_5k_zk^2 + c_6k_z^3)\sigma_0 + [i(c_7k_+^3 + c_8k_-^3)\sigma_+ + h.c.]; \\
&\quad R_8; c_2(\sigma_2k_x + \sigma_1k_y) + \sigma_0(c_3k_z + c_1); \\
&\quad R_9; c_2(\sigma_1k_y - \sigma_2k_x) + \sigma_0(c_3k_z + c_1); \\
&U; R_5; c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
&P; R_6; c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_7\}, \{R_8\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{1,3}k_x - \Gamma_{2,0}k_y) + c_5(\Gamma_{2,3}k_x + \Gamma_{1,0}k_y) + [ic_6(\Gamma_{0,+} - \Gamma_{3,+})k_+ + h.c.]; \\
&\quad \{R_7\}, \{R_9\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{1,3}k_x + \Gamma_{2,0}k_y) + c_5(\Gamma_{1,0}k_y - \Gamma_{2,3}k_x) + [ic_6(\Gamma_{0,+} - \Gamma_{3,+})k_- + h.c.]; \\
&\quad \{R_8\}, \{R_9\}; \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + [ic_4(\Gamma_{0,+} - \Gamma_{3,+})k_- - ic_5(\Gamma_{0,+} + \Gamma_{3,+})k_+ + h.c.]; \\
&P; \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
&\quad \{R_3\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_6c_4 + 2A_7c_5 - A_2c_6)k_x + [A_4c_4 + (A_5 - \sqrt{3}A_8)c_5 - A_1c_6]k_y; \\
&\quad \{R_4\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_4c_4 + 2A_7c_5 - A_1c_6)k_x - [A_6c_4 - (A_5 - \sqrt{3}A_8)c_5 - A_2c_6]k_y; \\
&T; \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + c_4\sigma_1(k_x - \sqrt{3}k_y); \\
&S; \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + c_4\sigma_1(k_x - \sqrt{3}k_y); \\
&T'; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x; \\
&S'; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x; \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y; \\
&R; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y;
\end{aligned}$$

$\Gamma_h; \{C_6^+|000\}, \{\sigma_{d1}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \quad R_7; & \quad c_1\sigma_0; \\
& R_8; \quad c_2(\sigma_2k_x + \sigma_1k_y) + c_1\sigma_0; \\
& R_9; \quad c_2(\sigma_1k_y - \sigma_2k_x) + c_1\sigma_0; \\
M; \quad R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + c_1\sigma_0; \\
A; \quad \{R_7, R_7\}; & \quad c_1\Gamma_{0,0} + c_2(\Gamma_{3,2}k_x + \Gamma_{3,1}k_y) + c_3\Gamma_{3,0}k_z + [\alpha_1k_z\Gamma_{+,0} + \alpha_2(k_x\Gamma_{+,2} + k_y\Gamma_{+,1}) + h.c.]; \\
& \{R_8, R_8\}; & \quad c_1\Gamma_{0,0} + c_2(\Gamma_{3,2}k_x - \Gamma_{3,1}k_y) + c_3\Gamma_{3,0}k_z + [\alpha_1k_z\Gamma_{+,0} + \alpha_2(k_x\Gamma_{+,2} - k_y\Gamma_{+,1}) + h.c.]; \\
& \{R_9, R_9\}; & \quad (c_1 + c_2k^2 + c_3k_z^2)\Gamma_{0,0} + \\
& & \quad \sum_{i=1}^3 [\Gamma_{i,0}k_z(c_{i,1} + c_{i,2}k^2 + c_{i,3}k_z^2) + c_{i,4}\Gamma_{i,1}k_y(k_y^2 - 3k_x^2) + c_{i,5}\Gamma_{i,2}k_x(k_x^2 - 3k_y^2)]; \\
L; \quad \{R_9, R_9\}; & \quad c_1\Gamma_{0,0} + \sum_{i=1}^3 (c_{i,1}\Gamma_{i,1}k_x + c_{i,2}\Gamma_{i,2}k_y + c_{i,3}\Gamma_{i,0}k_z); \\
K; \quad R_6; & \quad c_2(\sigma_1k_x - \sigma_3k_y) + c_1\sigma_0; \\
H; \quad \{R_1, R_2\}; & \quad c_2\sigma_3k_z + c_1\sigma_0; \\
& \{R_5, R_5\}; & \quad c_1\Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1}(\Gamma_{i,1}k_x + \Gamma_{i,3}k_y) + c_{i,2}\Gamma_{i,0}k_z]; \\
\Delta; \quad R_7; & \quad (c_1 + c_2k_z + c_3k^2 + c_4k_z^2 + c_5k_zk^2 + c_6k_z^3)\sigma_0 + [i(c_7k_+^3 + c_8k_-^3)\sigma_+ + h.c.]; \\
& R_8; & \quad c_2(\sigma_2k_x + \sigma_1k_y) + \sigma_0(c_3k_z + c_1); \\
& R_9; & \quad c_2(\sigma_1k_y - \sigma_2k_x) + \sigma_0(c_3k_z + c_1); \\
U; \quad R_5; & \quad c_2\sigma_1k_x + c_3\sigma_3k_y + \sigma_0(c_4k_z + c_1); \\
P; \quad R_6; & \quad c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
S; \quad \{R_2, R_4\}; & \quad \left[c_1 + c_2\left(k_x + \frac{k_y}{\sqrt{3}}\right)\right]\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)(k_x - \sqrt{3}k_y) + c_5\sigma_3k_z; \\
S'; \quad \{R_2, R_4\}; & \quad \sigma_0(c_2k_y + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_x + c_4\sigma_3k_z; \\
R; \quad \{R_2, R_4\}; & \quad \sigma_0(c_2k_x + c_1) + (c_3\sigma_1 - c_5\sigma_2)k_y + c_4\sigma_3k_z;
\end{aligned}$$

#### Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad \{R_7\}, \{R_8\}; & \quad \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{1,3}k_x - \Gamma_{2,0}k_y) + c_5(\Gamma_{2,3}k_x + \Gamma_{1,0}k_y) + [ic_6(\Gamma_{0,+} - \Gamma_{3,+})k_+ + h.c.]; \\
& \{R_7\}, \{R_9\}; & \quad \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + c_4(\Gamma_{1,3}k_x + \Gamma_{2,0}k_y) + c_5(\Gamma_{1,0}k_y - \Gamma_{2,3}k_x) + [ic_6(\Gamma_{0,+} - \Gamma_{3,+})k_- + h.c.]; \\
& \{R_8\}, \{R_9\}; & \quad \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + [ic_4(\Gamma_{0,+} - \Gamma_{3,+})k_- - ic_5(\Gamma_{0,+} + \Gamma_{3,+})k_+ + h.c.]; \\
P; \quad \{R_3\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
& \{R_3\}, \{R_6\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_6c_4 + 2A_7c_5 - A_2c_6)k_x + [A_4c_4 + (A_5 - \sqrt{3}A_8)c_5 - A_1c_6]k_y; \\
& \{R_4\}, \{R_6\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_4c_4 + 2A_7c_5 - A_1c_6)k_x - [A_6c_4 - (A_5 - \sqrt{3}A_8)c_5 - A_2c_6]k_y; \\
T; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + c_4\sigma_1(k_x - \sqrt{3}k_y); \\
T'; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_x; \\
\Sigma; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y;
\end{aligned}$$

$\Gamma_h; \{C_6^+ | 00\frac{1}{2}\}, \{\sigma_{d1} | 000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
\Gamma; R_7; & c_1 \sigma_0; \\
R_8; & c_2 (\sigma_2 k_x + \sigma_1 k_y) + c_1 \sigma_0; \\
R_9; & c_2 (\sigma_1 k_y - \sigma_2 k_x) + c_1 \sigma_0; \\
M; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
A; \{R_{13}, R_{13}\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + c_4 \Gamma_{0,1} k_y (k_y^2 - 3k_x^2) + \\
& \sum_{i=1}^3 [\Gamma_{i,0} k_z (c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} \Gamma_{i,2} k_x (k_x^2 - 3k_y^2)]; \\
& \{R_{14}, R_{15}\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x + \Gamma_{3,3} k_y) + c_3 \Gamma_{3,0} k_z; \\
L; \{R_9, R_9\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,3} k_y + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,1} k_x + c_{i,2} \Gamma_{i,0} k_z); \\
K; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
H; \{R_3, R_3\}; & (c_3 \sigma_1 - c_4 \sigma_2 + c_2 \sigma_3) k_z + c_1 \sigma_0; \\
& \{R_4, R_4\}; (c_3 \sigma_1 - c_4 \sigma_2 + c_2 \sigma_3) k_z + c_1 \sigma_0; \\
& \{R_6, R_6\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,1} k_x - \Gamma_{0,3} k_y) + \sum_{i=1}^3 c_{i,1} \Gamma_{i,0} k_z; \\
\Delta; R_7; & (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2 + c_5 k_z k^2 + c_6 k_z^3) \sigma_0 + [i (c_7 k_+^3 + c_8 k_-^3) \sigma_+ + h.c.]; \\
R_8; & c_2 (\sigma_2 k_x + \sigma_1 k_y) + \sigma_0 (c_3 k_z + c_1); \\
R_9; & c_2 (\sigma_1 k_y - \sigma_2 k_x) + \sigma_0 (c_3 k_z + c_1); \\
U; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + \sigma_0 (c_4 k_z + c_1); \\
P; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
S; \{R_2, R_2\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
& \{R_4, R_4\}; \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
S'; \{R_2, R_2\}; & \sigma_0 (c_1 + c_2 k_y) + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
& \{R_4, R_4\}; \sigma_0 (c_1 + c_2 k_y) + \sum_{i=1}^3 c_{i,1} \sigma_i k_z; \\
R; \{R_2, R_4\}; & \sigma_0 (c_1 + c_2 k_x) + c_3 \sigma_3 k_z;
\end{aligned}$$

#### Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_7\}, \{R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,3} k_x - \Gamma_{2,0} k_y) + c_5 (\Gamma_{2,3} k_x + \Gamma_{1,0} k_y) + [ic_6 (\Gamma_{0,+} - \Gamma_{3,+}) k_+ + h.c.]; \\
& \{R_7\}, \{R_9\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,3} k_x + \Gamma_{2,0} k_y) + c_5 (\Gamma_{1,0} k_y - \Gamma_{2,3} k_x) + [ic_6 (\Gamma_{0,+} - \Gamma_{3,+}) k_- + h.c.]; \\
& \{R_8\}, \{R_9\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + [ic_4 (\Gamma_{0,+} - \Gamma_{3,+}) k_- - ic_5 (\Gamma_{0,+} + \Gamma_{3,+}) k_+ + h.c.]; \\
P; \{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
& \{R_3\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (A_6 c_4 + 2A_7 c_5 - A_2 c_6) k_x + [A_4 c_4 + (A_5 - \sqrt{3} A_8) c_5 - A_1 c_6] k_y; \\
& \{R_4\}, \{R_6\}; A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (A_4 c_4 + 2A_7 c_5 - A_1 c_6) k_x - [A_6 c_4 - (A_5 - \sqrt{3} A_8) c_5 - A_2 c_6] k_y; \\
T; \{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + c_3 \sigma_3 (\sqrt{3} k_x + k_y) + c_4 \sigma_1 (k_x - \sqrt{3} k_y); \\
S; \{R_2, R_2\}, \{R_4, R_4\}; & c_1 \Gamma_{0,0} + \sum_{i=0,3} c_{i,1} (\sqrt{3} k_x + k_y) \Gamma_{i,0} + \\
& [(k_x - \sqrt{3} k_y) (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3} + \alpha_1 \Gamma_{2,+}) + \sum_{i=0,3} (c_{i,2} \Gamma_{i,3} + \alpha_{i,1} \Gamma_{i,+}) k_z + h.c.]; \\
T'; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x; \\
S'; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + [k_x (c_4 \Gamma_{1,3} + c_5 \Gamma_{2,0} + \alpha_1 \Gamma_{1,+}) + \sum_{i=0,3} (c_{i,1} \Gamma_{i,3} + \alpha_{i,1} \Gamma_{i,+}) k_z + h.c.]; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y;
\end{aligned}$$

$\Gamma_h; \{C_6^+ | 00\frac{1}{2}\}, \{\sigma_{d1} | 00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_7; & c_1 \sigma_0; \\
R_8; & c_2 (\sigma_2 k_x + \sigma_1 k_y) + c_1 \sigma_0; \\
R_9; & c_2 (\sigma_1 k_y - \sigma_2 k_x) + c_1 \sigma_0; \\
M; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + c_1 \sigma_0; \\
A; \{R_{13}, R_{13}\}; & (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + c_4 \Gamma_{0,1} k_x (k_x^2 - 3k_y^2) + \\
& \sum_{i=1}^3 [\Gamma_{i,0} k_z (c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) + c_{i,4} \Gamma_{i,2} k_y (k_y^2 - 3k_x^2)]; \\
& \{R_{14}, R_{15}\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,3} k_x - \Gamma_{3,1} k_y) + c_3 \Gamma_{3,0} k_z; \\
L; \{R_9, R_9\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,3} k_x + \sum_{i=1}^3 (c_{i,1} \Gamma_{i,1} k_y + c_{i,2} \Gamma_{i,0} k_z); \\
K; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
H; \{R_1, R_2\}; & c_2 \sigma_3 k_z + c_1 \sigma_0; \\
R_5; & c_1 \sigma_0; \\
\Delta; R_7; & (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2 + c_5 k_z k^2 + c_6 k_z^3) \sigma_0 + [i (c_7 k_+^3 + c_8 k_-^3) \sigma_+ + h.c.]; \\
R_8; & c_2 (\sigma_2 k_x + \sigma_1 k_y) + \sigma_0 (c_3 k_z + c_1); \\
R_9; & c_2 (\sigma_1 k_y - \sigma_2 k_x) + \sigma_0 (c_3 k_z + c_1); \\
U; R_5; & c_2 \sigma_1 k_x + c_3 \sigma_3 k_y + \sigma_0 (c_4 k_z + c_1); \\
P; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + \sigma_0 (c_3 k_z + c_1); \\
S; \{R_2, R_4\}; & \sigma_0 [c_2 (\sqrt{3} k_x + k_y) + c_1] + c_3 \sigma_3 k_z; \\
S'; \{R_2, R_4\}; & \sigma_0 (c_2 k_y + c_1) + c_3 \sigma_3 k_z; \\
R; \{R_2, R_2\}; & \sigma_0 (c_2 k_x + c_1) + (c_4 \sigma_1 + c_5 \sigma_2 + c_3 \sigma_3) k_z; \\
& \{R_4, R_4\}; \sigma_0 (c_2 k_x + c_1) + (c_4 \sigma_1 + c_5 \sigma_2 + c_3 \sigma_3) k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_7\}, \{R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,3} k_x - \Gamma_{2,0} k_y) + c_5 (\Gamma_{2,3} k_x + \Gamma_{1,0} k_y) + [ic_6 (\Gamma_{0,+} - \Gamma_{3,+}) k_+ + h.c.]; \\
\{R_7\}, \{R_9\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,3} k_x + \Gamma_{2,0} k_y) + c_5 (\Gamma_{1,0} k_y - \Gamma_{2,3} k_x) + [ic_6 (\Gamma_{0,+} - \Gamma_{3,+}) k_- + h.c.]; \\
\{R_8\}, \{R_9\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + [ic_4 (\Gamma_{0,+} - \Gamma_{3,+}) k_- - ic_5 (\Gamma_{0,+} + \Gamma_{3,+}) k_+ + h.c.]; \\
P; \{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
\{R_3\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (A_6 c_4 + 2A_7 c_5 - A_2 c_6) k_x + [A_4 c_4 + (A_5 - \sqrt{3} A_8) c_5 - A_1 c_6] k_y; \\
\{R_4\}, \{R_6\}; & A_0 (c_1 + c_2 k_z) + (\sqrt{3} A_5 + A_8) c_3 k_z + (A_4 c_4 + 2A_7 c_5 - A_1 c_6) k_x - [A_6 c_4 - (A_5 - \sqrt{3} A_8) c_5 - A_2 c_6] k_y; \\
T; \{R_2\}, \{R_4\}; & \sigma_0 [c_1 + c_2 (\sqrt{3} k_x + k_y)] + c_3 \sigma_3 (\sqrt{3} k_x + k_y) + c_4 \sigma_1 (k_x - \sqrt{3} k_y); \\
T'; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_2 k_x; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y; \\
R; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + [k_y (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3} + \alpha_1 \Gamma_{2,+}) + \sum_{i=0,3} (c_{i,1} \Gamma_{i,3} + \alpha_{i,1} \Gamma_{i,+}) k_z + h.c.]
\end{aligned}$$

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 $\Gamma_h; \{S_3^+|000\}, \{C_{21}'|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
 \Gamma; & R_7; c_1\sigma_0 - c_2\sigma_2k_z; \\
 & R_8; c_1\sigma_0; \\
 & R_9; c_1\sigma_0; \\
 M; & R_5; c_2\sigma_3k_y + c_3\sigma_1k_z + c_1\sigma_0; \\
 A; & R_7; c_1\sigma_0 - c_2\sigma_2k_z; \\
 & R_8; c_1\sigma_0; \\
 & R_9; c_1\sigma_0; \\
 L; & R_5; c_2\sigma_3k_y + c_3\sigma_1k_z + c_1\sigma_0; \\
 \Delta; & R_6; (c_1 + c_2k_z + c_3k^2 + c_4k_z^2)\sigma_0 + c_5 [2\sigma_1k_xk_y + \sigma_3(k_y^2 - k_x^2)]; \\
 \Sigma; & R_5; \sigma_0(c_2k_x + c_1) + c_3\sigma_3k_y + c_4\sigma_1k_z; \\
 R; & R_5; \sigma_0(c_2k_x + c_1) + c_3\sigma_3k_y + c_4\sigma_1k_z;
 \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Delta; & \{R_3\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
 & \{R_3\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + c_4(A_2k_y - A_1k_x); \\
 & \{R_4\}, \{R_6\}; A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + c_4(A_2k_x + A_1k_y); \\
 U; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_2k_y; \\
 P; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4[\sigma_1(\sqrt{3}k_x - k_y) + \sigma_2(k_x + \sqrt{3}k_y)]; \\
 & \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4[\sigma_1(\sqrt{3}k_x - k_y) - \sigma_2(k_x + \sqrt{3}k_y)]; \\
 & \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4[\sigma_1(\sqrt{3}k_x - k_y) + \sigma_2(k_x + \sqrt{3}k_y)]; \\
 T; & \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + c_4\sigma_2k_z; \\
 S; & \{R_2\}, \{R_4\}; \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + c_4\sigma_2k_z; \\
 T'; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_z; \\
 S'; & \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_z;
 \end{aligned}$$



$\Gamma_h; \{S_3^+|000\}, \{C'_{21}|00\frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_7; & c_1\sigma_0 - c_2\sigma_2k_z; \\
R_8; & c_1\sigma_0; \\
R_9; & c_1\sigma_0; \\
M; R_5; & c_2\sigma_3k_y + c_3\sigma_1k_z + c_1\sigma_0; \\
A; \{R_5, R_7\}; & (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
\{R_6, R_8\}; & (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
\{R_{11}, R_{12}\}; & c_1\Gamma_{0,0} + c_2(\Gamma_{3,1}k_x - \Gamma_{0,2}k_y) + k_z(c_3\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
L; \{R_5, R_6\}; & c_2\sigma_3k_x + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
\{R_7, R_8\}; & c_2\sigma_3k_x + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
H; \{R_2, R_8\}; & (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
\{R_4, R_{10}\}; & (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
\{R_6, R_{12}\}; & (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
\Delta; R_6; & (c_1 + c_2k_z + c_3k^2 + c_4k_z^2)\sigma_0 + c_5[2\sigma_1k_xk_y + \sigma_3(k_y^2 - k_x^2)]; \\
S; \{R_2, R_4\}; & [c_1 + c_2(\sqrt{3}k_x + k_y)]\sigma_0 + c_3\sigma_3(k_x - \sqrt{3}k_y) + \sum_{i=1}^2 c_{i,1}\sigma_i k_z; \\
S'; \{R_2, R_4\}; & \sigma_0(c_3k_y + c_1) + c_2\sigma_3k_x + (c_4\sigma_1 - c_5\sigma_2)k_z; \\
\Sigma; R_5; & \sigma_0(c_2k_x + c_1) + c_3\sigma_3k_y + c_4\sigma_1k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_3\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
\{R_3\}, \{R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + c_4(A_2k_y - A_1k_x); \\
\{R_4\}, \{R_6\}; & A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + c_4(A_2k_x + A_1k_y); \\
U; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_2k_y; \\
P; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4[\sigma_1(\sqrt{3}k_x - k_y) + \sigma_2(k_x + \sqrt{3}k_y)]; \\
\{R_2\}, \{R_6\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4[\sigma_1(\sqrt{3}k_x - k_y) - \sigma_2(k_x + \sqrt{3}k_y)]; \\
\{R_4\}, \{R_6\}; & \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4[\sigma_1(\sqrt{3}k_x - k_y) + \sigma_2(k_x + \sqrt{3}k_y)]; \\
T; \{R_2\}, \{R_4\}; & \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + c_4\sigma_2k_z; \\
T'; \{R_2\}, \{R_4\}; & \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4\sigma_2k_z; \\
R; \{R_5\}, \{R_6\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x; \\
\{R_5\}, \{R_7\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
\{R_5\}, \{R_8\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
\{R_6\}, \{R_7\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + (c_4\sigma_1 + c_5\sigma_2)k_y; \\
\{R_6\}, \{R_8\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
\{R_7\}, \{R_8\}; & \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x;
\end{aligned}$$

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 $\Gamma_h; \{S_3^+|000\}, \{C_{21}''|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
&\Gamma; \quad R_7; \quad c_1\sigma_0 - c_2\sigma_2k_z; \\
&\quad R_8; \quad c_1\sigma_0; \\
&\quad R_9; \quad c_1\sigma_0; \\
&M; \quad R_5; \quad c_2\sigma_3k_x + c_3\sigma_1k_z + c_1\sigma_0; \\
&A; \quad R_7; \quad c_1\sigma_0 - c_2\sigma_2k_z; \\
&\quad R_8; \quad c_1\sigma_0; \\
&\quad R_9; \quad c_1\sigma_0; \\
&L; \quad R_5; \quad c_2\sigma_3k_x + c_3\sigma_1k_z + c_1\sigma_0; \\
&K; \quad R_7; \quad c_1\sigma_0 - c_2\sigma_2k_z; \\
&\quad R_8; \quad c_1\sigma_0; \\
&\quad R_9; \quad c_1\sigma_0; \\
&H; \quad R_7; \quad c_1\sigma_0 - c_2\sigma_2k_z; \\
&\quad R_8; \quad c_1\sigma_0; \\
&\quad R_9; \quad c_1\sigma_0; \\
&\Delta; \quad R_6; \quad (c_1 + c_2k_z + c_3k^2 + c_4k_z^2) \sigma_0 + c_5 [2\sigma_1k_xk_y + \sigma_3(k_y^2 - k_x^2)]; \\
&P; \quad R_6; \quad c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
&T; \quad R_5; \quad \sigma_0 [c_2(\sqrt{3}k_x + k_y) + c_1] + c_3\sigma_3(k_x - \sqrt{3}k_y) + c_4\sigma_1k_z; \\
&S; \quad R_5; \quad \sigma_0 [c_2(\sqrt{3}k_x + k_y) + c_1] + c_3\sigma_3(k_x - \sqrt{3}k_y) + c_4\sigma_1k_z; \\
&T'; \quad R_5; \quad \sigma_0(c_3k_y + c_1) + c_2\sigma_3k_x + c_4\sigma_1k_z; \\
&S'; \quad R_5; \quad \sigma_0(c_3k_y + c_1) + c_2\sigma_3k_x + c_4\sigma_1k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_3\}, \{R_4\}; \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
&\quad \{R_3\}, \{R_6\}; \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + c_4(A_2k_y - A_1k_x); \\
&\quad \{R_4\}, \{R_6\}; \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + c_4(A_2k_x + A_1k_y); \\
&U; \{R_2\}, \{R_4\}; \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_2k_x; \\
&P; \{R_3\}, \{R_4\}; \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
&\quad \{R_3\}, \{R_6\}; \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_6c_4 + 2A_7c_5 - A_2c_6)k_x + [A_4c_4 + (A_5 - \sqrt{3}A_8)c_5 - A_1c_6]k_y; \\
&\quad \{R_4\}, \{R_6\}; \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_4c_4 + 2A_7c_5 - A_1c_6)k_x - [A_6c_4 - (A_5 - \sqrt{3}A_8)c_5 - A_2c_6]k_y; \\
&\Sigma; \{R_2\}, \{R_4\}; \quad \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_z; \\
&R; \{R_2\}, \{R_4\}; \quad \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_z;
\end{aligned}$$

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 $\Gamma_h; \{S_3^+|000\}, \{C_{21}''|00\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 


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$$\begin{aligned}
\Gamma; \quad R_7; & \quad c_1\sigma_0 - c_2\sigma_2k_z; \\
& R_8; & \quad c_1\sigma_0; \\
& R_9; & \quad c_1\sigma_0; \\
M; \quad R_5; & \quad c_2\sigma_3k_x + c_3\sigma_1k_z + c_1\sigma_0; \\
A; \quad \{R_5, R_7\}; & \quad (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
& \{R_6, R_8\}; & \quad (c_2\sigma_1 - c_3\sigma_2)k_z + c_1\sigma_0; \\
& \{R_{11}, R_{12}\}; & \quad c_1\Gamma_{0,0} + c_2(\Gamma_{0,2}k_x + \Gamma_{3,1}k_y) + k_z(c_3\Gamma_{1,1} - c_4\Gamma_{2,1}); \\
L; \quad \{R_5, R_6\}; & \quad c_2\sigma_3k_y + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
& \{R_7, R_8\}; & \quad c_2\sigma_3k_y + (c_3\sigma_1 - c_4\sigma_2)k_z + c_1\sigma_0; \\
K; \quad R_7; & \quad c_1\sigma_0 - c_2\sigma_2k_z; \\
& R_8; & \quad c_1\sigma_0; \\
& R_9; & \quad c_1\sigma_0; \\
H; \quad R_{11}; & \quad c_2(\sigma_2k_x + \sigma_1k_y) + c_1\sigma_0; \\
& R_{12}; & \quad c_2(\sigma_2k_x + \sigma_1k_y) + c_1\sigma_0; \\
\Delta; \quad R_6; & \quad (c_1 + c_2k_z + c_3k^2 + c_4k_z^2)\sigma_0 + c_5[2\sigma_1k_xk_y + \sigma_3(k_y^2 - k_x^2)]; \\
P; \quad R_6; & \quad c_2(\sigma_1k_x - \sigma_3k_y) + \sigma_0(c_3k_z + c_1); \\
T; \quad R_5; & \quad \sigma_0[c_2(\sqrt{3}k_x + k_y) + c_1] + c_3\sigma_3(k_x - \sqrt{3}k_y) + c_4\sigma_1k_z; \\
T'; \quad R_5; & \quad \sigma_0(c_2k_y + c_1) + c_3\sigma_3k_x + c_4\sigma_1k_z; \\
R; \quad \{R_2, R_4\}; & \quad \sigma_0(c_2k_x + c_1) + c_3\sigma_3k_y + (c_4\sigma_1 - c_5\sigma_2)k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

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$$\begin{aligned}
\Delta; \quad \{R_3\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
& \{R_3\}, \{R_6\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + c_4(A_2k_y - A_1k_x); \\
& \{R_4\}, \{R_6\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + c_4(A_2k_x + A_1k_y); \\
U; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_2k_x; \\
P; \quad \{R_3\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z; \\
& \{R_3\}, \{R_6\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_6c_4 + 2A_7c_5 - A_2c_6)k_x + [A_4c_4 + (A_5 - \sqrt{3}A_8)c_5 - A_1c_6]k_y; \\
& \{R_4\}, \{R_6\}; & \quad A_0(c_1 + c_2k_z) + (\sqrt{3}A_5 + A_8)c_3k_z + (A_4c_4 + 2A_7c_5 - A_1c_6)k_x - [A_6c_4 - (A_5 - \sqrt{3}A_8)c_5 - A_2c_6]k_y; \\
S; \quad \{R_5\}, \{R_6\}; & \quad \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y); \\
& \{R_5\}, \{R_7\}; & \quad \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
& \{R_5\}, \{R_8\}; & \quad \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + (c_4\sigma_1 + c_5\sigma_2)(k_x - \sqrt{3}k_y); \\
& \{R_6\}, \{R_7\}; & \quad \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + (c_4\sigma_1 + c_5\sigma_2)(k_x - \sqrt{3}k_y); \\
& \{R_6\}, \{R_8\}; & \quad \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y) + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
& \{R_7\}, \{R_8\}; & \quad \sigma_0[c_1 + c_2(\sqrt{3}k_x + k_y)] + \sigma_3c_3(\sqrt{3}k_x + k_y); \\
S'; \quad \{R_5\}, \{R_6\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y; \\
& \{R_5\}, \{R_7\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
& \{R_5\}, \{R_8\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_x; \\
& \{R_6\}, \{R_7\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_x; \\
& \{R_6\}, \{R_8\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + (c_4\sigma_1 + c_5\sigma_2)k_z; \\
& \{R_7\}, \{R_8\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y; \\
\Sigma; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_2k_z;
\end{aligned}$$

## SG 191

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 $\Gamma_h; \{C_6^+|000\}, \{C_{21}'|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_7\}, \{R_8\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4(\Gamma_{2,3} k_x + \Gamma_{1,0} k_y); \\ \{R_7\}, \{R_9\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4(\Gamma_{1,0} k_y - \Gamma_{2,3} k_x); \\ \{R_8\}, \{R_9\}; & \quad \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0}(c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + c_2[\Gamma_{1,0}(k_x^2 - k_y^2) + 2\Gamma_{2,3} k_x k_y]; \\ P; \{R_3, R_4\}, \{R_6\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4(\Gamma_{2,2} k_x - \Gamma_{1,0} k_y) + c_5(\Gamma_{2,1} k_x + \Gamma_{2,3} k_y); \end{aligned}$$

## SG 192

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 $\Gamma_h; \{C_6^+|000\}, \{C_{21}'|00\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} A; \{R_{19}, R_{20}\}; & \quad (c_1 + c_2 k^2 + c_3 k_z^2) \Gamma_{0,0} + \sum_{i=1}^2 \Gamma_{i,1} k_z (c_{i,1} + c_{i,2} k^2 + c_{i,3} k_z^2) + c_4 \Gamma_{0,2} k_x (k_x^2 - 3k_y^2) + c_5 \Gamma_{3,1} k_y (k_y^2 - 3k_x^2); \\ \{R_{21}, R_{23}\}; & \quad c_1 \Gamma_{0,0} + c_2(\Gamma_{0,2} k_x + \Gamma_{3,1} k_y) + k_z(c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1}); \\ \{R_{22}, R_{24}\}; & \quad c_1 \Gamma_{0,0} + c_2(\Gamma_{0,2} k_x + \Gamma_{3,1} k_y) + k_z(c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1}); \\ L; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} - c_4 \Gamma_{0,2} k_x + c_2 \Gamma_{3,1} k_y + k_z(c_3 \Gamma_{1,1} - c_5 \Gamma_{2,1}); \\ H; \{R_{11}, R_{12}\}; & \quad c_1 \Gamma_{0,0} + c_2(\Gamma_{3,2} k_x + \Gamma_{0,1} k_y) - k_z(c_4 \Gamma_{1,2} + c_3 \Gamma_{2,2}); \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_7\}, \{R_8\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4(\Gamma_{2,3} k_x + \Gamma_{1,0} k_y); \\ \{R_7\}, \{R_9\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4(\Gamma_{1,0} k_y - \Gamma_{2,3} k_x); \\ \{R_8\}, \{R_9\}; & \quad \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0}(c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + c_2[\Gamma_{1,0}(k_x^2 - k_y^2) + 2\Gamma_{2,3} k_x k_y]; \\ P; \{R_3, R_4\}, \{R_6\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4(\Gamma_{2,2} k_x - \Gamma_{1,0} k_y) + c_5(\Gamma_{2,1} k_x + \Gamma_{2,3} k_y); \\ S; \{R_5, R_6\}, \{R_7, R_8\}; & \quad \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0} c_{i,1}(\sqrt{3} k_x + k_y) + (c_2 \Gamma_{2,1} + c_3 \Gamma_{2,2})(\sqrt{3} k_y - k_x) + (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) k_z; \\ S'; \{R_5, R_6\}, \{R_7, R_8\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x(c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z(c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \\ R; \{R_5, R_6\}, \{R_7, R_8\}; & \quad \Gamma_{0,0}(c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y(c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z(c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \end{aligned}$$

## SG 193

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 $\Gamma_h; \{C_6^+|00\frac{1}{2}\}, \{C_{21}'|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} A; \{R_{15}, R_{16}\}; & \quad c_1 \Gamma_{0,0} + k_z(c_2 \Gamma_{1,3} + c_3 \Gamma_{2,3}); \\ R_{24}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{3,3} k_z; \\ L; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{3,1} k_x + k_z(c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1}); \\ H; \{R_7, R_7\}; & \quad c_1 \Gamma_{0,0} + k_z(c_4 \Gamma_{1,2} + c_2 \Gamma_{2,2} + c_3 \Gamma_{3,2}); \\ \{R_8, R_9\}; & \quad c_1 \Gamma_{0,0} + k_z(c_3 \Gamma_{1,2} + c_2 \Gamma_{2,2}); \\ S; \{R_9, R_9\}; & \quad \left[ c_1 + c_2 \left( k_x + \frac{k_y}{\sqrt{3}} \right) \right] \Gamma_{0,0} + c_3 \Gamma_{0,2}(\sqrt{3} k_y - k_x) + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_z; \\ S'; \{R_9, R_9\}; & \quad (c_1 + c_2 k_y) \Gamma_{0,0} + c_3 \Gamma_{0,2} k_x + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_z; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_7\}, \{R_8\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,3} k_x + \Gamma_{1,0} k_y); \\
\{R_7\}, \{R_9\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_y - \Gamma_{2,3} k_x); \\
\{R_8\}, \{R_9\}; & \quad \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + c_2 [\Gamma_{1,0} (k_x^2 - k_y^2) + 2\Gamma_{2,3} k_x k_y]; \\
P; \{R_3, R_4\}, \{R_6\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,2} k_x - \Gamma_{1,0} k_y) + c_5 (\Gamma_{2,1} k_x + \Gamma_{2,3} k_y); \\
R; \{R_5, R_6\}, \{R_7, R_8\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_z (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3});
\end{aligned}$$

SG 194

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 $\Gamma_h; \{C_6^+ | 00\frac{1}{2}\}, \{C_{21}' | 00\frac{1}{2}\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
A; \{R_{15}, R_{16}\}; & \quad c_1 \Gamma_{0,0} + k_z (c_2 \Gamma_{1,3} - c_3 \Gamma_{2,3}); \\
R_{24}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{3,3} k_z; \\
L; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{3,1} k_y + k_z (c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1}); \\
R; \{R_9, R_9\}; & \quad (c_1 + c_2 k_x) \Gamma_{0,0} + c_3 \Gamma_{0,1} k_y + \sum_{i=1}^3 c_{i,1} \Gamma_{i,3} k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_7\}, \{R_8\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,3} k_x + \Gamma_{1,0} k_y); \\
\{R_7\}, \{R_9\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_y - \Gamma_{2,3} k_x); \\
\{R_8\}, \{R_9\}; & \quad \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + c_2 [\Gamma_{1,0} (k_x^2 - k_y^2) + 2\Gamma_{2,3} k_x k_y]; \\
P; \{R_3, R_4\}, \{R_6\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{2,2} k_x - \Gamma_{1,0} k_y) + c_5 (\Gamma_{2,1} k_x + \Gamma_{2,3} k_y); \\
S; \{R_5, R_6\}, \{R_7, R_8\}; & \quad \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} (\sqrt{3} k_x + k_y) + k_z (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}); \\
S'; \{R_5, R_6\}, \{R_7, R_8\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_z (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3});
\end{aligned}$$

SG 195

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 $\Gamma_c; \{C_{31}^- | 000\}, \{C_{2x} | 000\}, \{\bar{C}_{2y} | 000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_4; & \quad c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z) + c_1 \sigma_0; \\
\{R_5, R_6\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x - \Gamma_{0,2} k_y - \Gamma_{3,3} k_z) + \left[ \alpha_1 \left( k_x \Gamma_{+,3} - e^{i\pi/6} k_y \Gamma_{+,0} - e^{i\pi/3} k_z \Gamma_{+,1} \right) + h.c. \right]; \\
X; R_5; & \quad c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
M; R_5; & \quad c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\
R; R_4; & \quad c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z) + c_1 \sigma_0; \\
\{R_5, R_6\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x - \Gamma_{0,2} k_y - \Gamma_{3,3} k_z) + \left[ \alpha_1 \left( k_x \Gamma_{+,3} - e^{i\pi/6} k_y \Gamma_{+,0} - e^{i\pi/3} k_z \Gamma_{+,1} \right) + h.c. \right];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Lambda; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
\{R_2\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
\{R_4\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
Z; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
T; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_2 k_x + c_5 \sigma_1 k_y;
\end{aligned}$$

SG 196

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 $\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned} \Gamma; R_4; & \quad c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z) + c_1 \sigma_0; \\ & \{R_5, R_6\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x - \Gamma_{0,2} k_y - \Gamma_{3,3} k_z) + \left[ \alpha_1 \left( k_x \Gamma_{+,3} - e^{i\pi/6} k_y \Gamma_{+,0} - e^{i\pi/3} k_z \Gamma_{+,1} \right) + h.c. \right]; \\ X; R_5; & \quad c_2 \sigma_3 k_x + c_3 \sigma_1 k_y - c_4 \sigma_2 k_z + c_1 \sigma_0; \\ L; \{R_2, R_6\}; & \quad c_1 \sigma_0 + c_2 \sigma_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\ & \{R_4, R_4\}; (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + \sum_{i=1}^3 [(c_{i,1} + c_{i,2} q^2 + c_{i,3} q_z^2) q_z + c_{i,4} (q_y^2 - 3q_x^2) q_y + c_{i,5} q_x (q_x^2 - 3q_y^2)] \sigma_i; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\ \Lambda; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\ & \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\ & \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\ Z; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \end{aligned}$$

SG 197

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 $\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned} \Gamma; R_4; & \quad c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z) + c_1 \sigma_0; \\ & \{R_5, R_6\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x - \Gamma_{0,2} k_y - \Gamma_{3,3} k_z) + \left[ \alpha_1 \left( k_x \Gamma_{+,3} - e^{i\pi/6} k_y \Gamma_{+,0} - e^{i\pi/3} k_z \Gamma_{+,1} \right) + h.c. \right]; \\ H; R_4; & \quad c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z) + c_1 \sigma_0; \\ & \{R_5, R_6\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x - \Gamma_{0,2} k_y - \Gamma_{3,3} k_z) + \left[ \alpha_1 \left( k_x \Gamma_{+,3} - e^{i\pi/6} k_y \Gamma_{+,0} - e^{i\pi/3} k_z \Gamma_{+,1} \right) + h.c. \right]; \\ P; R_4; & \quad c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z) + c_1 \sigma_0; \\ & R_5; \quad c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z) + c_1 \sigma_0; \\ & R_6; \quad c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z) + c_1 \sigma_0; \\ N; \{R_2, R_4\}; & \quad \sigma_1 (c_2 k_x + c_3 k_y) + \sigma_2 (c_5 k_x + c_6 k_y) + c_4 \sigma_3 k_z + c_1 \sigma_0; \end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\ \Lambda; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\ & \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\ & \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\ D; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\ F; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 p_z) + \sigma_3 c_3 p_z + (\alpha_1 \sigma_+ p_- + h.c.); \\ & \{R_2\}, \{R_6\}; \sigma_0 (c_1 + c_2 p_z) + \sigma_3 c_3 p_z + (\alpha_1 \sigma_+ p_+ + h.c.); \\ & \{R_4\}, \{R_6\}; \sigma_0 (c_1 + c_2 p_z) + \sigma_3 c_3 p_z + (\alpha_1 \sigma_+ p_- + h.c.); \end{aligned}$$

SG 198

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 $\Gamma_c; \{C_{31}^-|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\bar{C}_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \quad & R_4; \quad c_2(\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z) + c_1 \sigma_0; \\
& \{R_5, R_6\}; \quad c_1 \Gamma_{0,0} + c_2(\Gamma_{3,1} k_x - \Gamma_{0,2} k_y - \Gamma_{3,3} k_z) + \left[ \alpha_1 \left( k_x \Gamma_{+,3} - e^{i\pi/6} k_y \Gamma_{+,0} - e^{i\pi/3} k_z \Gamma_{+,1} \right) + h.c. \right]; \\
X; \quad & \{R_5, R_6\}; \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
& \{R_7, R_8\}; \quad (c_2 \sigma_1 - c_3 \sigma_2) k_y + c_1 \sigma_0; \\
M; \quad & \{R_9, R_9\}; \quad c_1 \Gamma_{0,0} + k_x (c_3 \Gamma_{1,1} - c_6 \Gamma_{2,1} + c_2 \Gamma_{3,1}) - k_y (c_8 \Gamma_{1,2} + c_4 \Gamma_{2,2} + c_7 \Gamma_{3,2}) + c_5 \Gamma_{0,3} k_z; \\
R; \quad & \{R_1, R_1\}; \quad (c_1 + c_2 k^2) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_x k_y k_z; \\
& \{R_2, R_3\}; \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \sigma_3 k_x k_y k_z; \\
& \{R_7, R_7\}; \quad c_1 S_{0,0} + c_2 (S_{0,1} k_x - S_{0,2} k_y + S_{0,3} k_z) + \sum_{i=1}^3 c_{i,1} (S_{i,4} k_x + S_{i,6} k_y + S_{i,7} k_z); \\
S; \quad & \{R_2, R_2\}; \quad \sigma_0 (c_2 k_x + c_5 k_z + c_1) + (c_4 \sigma_1 - c_6 \sigma_2 + c_3 \sigma_3) k_y; \\
Z; \quad & \{R_5, R_7\}; \quad \sigma_0 (c_2 k_x + c_1) + (c_3 \sigma_1 - c_4 \sigma_2) k_y; \\
T; \quad & \{R_5, R_5\}; \quad (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_x k_y; \\
& \{R_7, R_7\}; \quad (c_1 + c_2 k^2 + c_3 k_z^2 + c_4 k_z) \sigma_0 + \sum_{i=1}^3 c_{i,1} \sigma_i k_x k_y;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Lambda; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
& \{R_2\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
& \{R_4\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
T; \quad & \{R_5, R_5\}, \{R_7, R_7\}; \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 \Gamma_{2,0} k_x + c_5 \Gamma_{1,0} k_y + \sum_{i=1}^3 (c_{i,1} \Gamma_{2,i} k_y + c_{i,2} \Gamma_{1,i} k_x);
\end{aligned}$$

SG 199

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 $\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\bar{C}_{2y}|0\frac{1}{2}\frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \quad & R_4; \quad c_2(\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z) + c_1 \sigma_0; \\
& \{R_5, R_6\}; \quad c_1 \Gamma_{0,0} + c_2(\Gamma_{3,1} k_x - \Gamma_{0,2} k_y - \Gamma_{3,3} k_z) + \left[ \alpha_1 \left( k_x \Gamma_{+,3} - e^{i\pi/6} k_y \Gamma_{+,0} - e^{i\pi/3} k_z \Gamma_{+,1} \right) + h.c. \right]; \\
H; \quad & R_4; \quad c_2(\sigma_3 k_x - \sigma_1 k_y + \sigma_2 k_z) + c_1 \sigma_0; \\
& \{R_5, R_6\}; \quad c_1 \Gamma_{0,0} + c_2(\Gamma_{3,1} k_y - \Gamma_{0,2} k_z - \Gamma_{3,3} k_x) + \left[ \alpha_1 \left( k_y \Gamma_{+,3} - e^{i\pi/6} k_z \Gamma_{+,0} - e^{i\pi/3} k_x \Gamma_{+,1} \right) + h.c. \right]; \\
P; \quad & R_7; \quad A_0 c_1 + c_2 (A_1 k_x - A_2 k_y + A_3 k_z) + c_3 (A_4 k_x + A_6 k_y + A_7 k_z); \\
N; \quad & \{R_2, R_4\}; \quad c_1 \sigma_0 + \sigma_1 (c_2 k_x + c_3 k_y) + \sigma_2 (c_5 k_x + c_6 k_y) + c_4 \sigma_3 k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 \sigma_1 k_x + c_5 \sigma_2 k_z; \\
\Lambda; \quad & \{R_2\}, \{R_4\}; \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
& \{R_2\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
& \{R_4\}, \{R_6\}; \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
D; \quad & \{R_5\}, \{R_7\}; \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + \sum_{i=1}^2 \sigma_i (c_{i,1} k_x + c_{i,2} k_y); \\
F; \quad & \{R_7\}, \{R_{11}\}; \quad \sigma_0 (c_1 + c_2 p_z) + \sigma_3 c_3 p_z + (\alpha_1 \sigma_+ p_+ + h.c.); \\
& \{R_7\}, \{R_9\}; \quad \sigma_0 (c_1 + c_2 p_z) + \sigma_3 c_3 p_z + (\alpha_1 \sigma_+ p_- + h.c.); \\
& \{R_9\}, \{R_{11}\}; \quad \sigma_0 (c_1 + c_2 p_z) + \sigma_3 c_3 p_z + (\alpha_1 \sigma_+ p_- + h.c.);
\end{aligned}$$

$\Gamma_c; \{C_{31}^-|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\bar{C}_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \{R_5, R_6\}; & \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
& c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
& \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
\{R_{12}, R_{13}\}; & \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
& c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
& \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
R; \{R_5, R_6\}; & \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
& c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
& \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
\{R_{12}, R_{13}\}; & \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
& c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
& \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2];
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\Lambda; \{R_2, R_6\}, \{R_4, R_4\}; \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + \Gamma_{1,0} (c_4 q_x + c_5 q_y) + \Gamma_{2,3} (c_5 q_x - c_4 q_y) + (\alpha_1 \Gamma_{2,+} q_+ + h.c.);$$



## SG 201

$\Gamma_c; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \{R_5, R_6\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
& \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
& \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
\{R_{12}, R_{13}\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
& \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
& \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
X; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{3,1} k_x + k_y (c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1}) + c_5 \Gamma_{0,2} k_z; \\
M; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_x + c_3 \Gamma_{3,1} k_y + k_z (c_4 \Gamma_{1,1} - c_5 \Gamma_{2,1}); \\
R; \{R_5, R_6\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
& \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
& \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
\{R_{12}, R_{13}\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
& \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
& \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2];
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_2, R_6\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + \Gamma_{1,0} (c_4 q_x + c_5 q_y) + \Gamma_{2,3} (c_5 q_x - c_4 q_y) + (\alpha_1 \Gamma_{2,+} q_+ + h.c.); \\
Z; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_1 \Gamma_{2,1} + c_2 \Gamma_{2,2}) + k_z (c_3 \Gamma_{2,3} + c_4 \Gamma_{1,0});
\end{aligned}$$

## SG 202

$\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \{R_5, R_6\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
& \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
& \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
\{R_{12}, R_{13}\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
& \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
& \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2];
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\Lambda; \{R_2, R_6\}, \{R_4, R_4\}; \quad \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + \Gamma_{1,0} (c_4 q_x + c_5 q_y) + \Gamma_{2,3} (c_5 q_x - c_4 q_y) + (\alpha_1 \Gamma_{2,+} q_+ + h.c.);$$

SG 203

 $\Gamma_c^f; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \{I|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} \Gamma; \{R_5, R_6\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\ & \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\ & \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\ \{R_{12}, R_{13}\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\ & \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\ & \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\ X; \{R_{13}, R_{14}\}; & \quad c_1 \Gamma_{0,0} + c_2 \Gamma_{3,1} k_x + k_y (c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1}) - c_5 \Gamma_{0,2} k_z; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_2, R_6\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + \Gamma_{1,0} (c_4 q_x + c_5 q_y) + \Gamma_{2,3} (c_5 q_x - c_4 q_y) + (\alpha_1 \Gamma_{2,+q_+} + h.c.); \\ Z; \{R_5, R_8\}, \{R_6, R_7\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \end{aligned}$$

SG 204

 $\Gamma_c^v; \{C_{31}^-|000\}, \{C_{2x}|000\}, \{\bar{C}_{2y}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} \Gamma; \{R_5, R_6\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\ & \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\ & \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\ \{R_{12}, R_{13}\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\ & \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\ & \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\ H; \{R_5, R_6\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\ & \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\ & \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\ \{R_{12}, R_{13}\}; & \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\ & \quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\ & \quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\ P; \{R_5, R_6\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,1} k_x - \Gamma_{3,2} k_y - \Gamma_{0,3} k_z); \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Lambda; \{R_2, R_6\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + \Gamma_{1,0} (c_4 q_x + c_5 q_y) + \Gamma_{2,3} (c_5 q_x - c_4 q_y) + (\alpha_1 \Gamma_{2,+q_+} + h.c.); \\ F; \{R_2, R_6\}, \{R_4, R_4\}; & \quad \Gamma_{0,0} (c_1 + c_2 p_z) + \Gamma_{3,0} c_3 p_z + \Gamma_{1,0} (c_4 p_x - c_5 p_y) + \Gamma_{2,3} (c_5 p_x + c_4 p_y) + (\alpha_1 \Gamma_{2,+p_-} + h.c.); \end{aligned}$$

$\Gamma_c; \{C_{31}^-|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\bar{C}_{2y}|0\frac{1}{2}\frac{1}{2}\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$$\begin{aligned}
&\Gamma; \{R_5, R_6\}; \quad \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
&\quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
&\quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
&\{R_{12}, R_{13}\}; \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
&\quad c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
&\quad \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
&X; \{R_{13}, R_{14}\}; c_1 \Gamma_{0,0} + k_y (c_2 \Gamma_{1,1} - c_3 \Gamma_{2,1}) + c_4 \Gamma_{0,2} k_z; \\
&M; \{R_9, R_9\}; \quad c_1 \Gamma_{0,0} + k_y (c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1} + c_2 \Gamma_{3,1}) + c_5 \Gamma_{0,2} k_z; \\
&\{R_{10}, R_{10}\}; c_1 \Gamma_{0,0} + k_y (c_3 \Gamma_{1,1} - c_4 \Gamma_{2,1} + c_2 \Gamma_{3,1}) + c_5 \Gamma_{0,2} k_z; \\
&R; \{R_7, R_7\}; \quad c_1 S_{0,0} + S_{0,0} \frac{c_2+c_3+c_4}{3} k^2 + \frac{1}{2} S_{0,5} [c_3 (k_y^2 - k_x^2) + c_2 (k_x^2 - k_z^2) + c_4 (k_z^2 - k_y^2)] + \\
&\quad \frac{(c_3(k_x^2+k_y^2-2k_z^2)+c_2(k_x^2-2k_y^2+k_z^2)+c_4(-2k_x^2+k_y^2+k_z^2))}{2\sqrt{3}} S_{0,8} + c_5 (S_{0,7} k_x k_y + S_{0,6} k_x k_z + S_{0,4} k_y k_z) + \\
&\quad \sum_{i=1}^3 c_{i,1} (S_{i,3} k_x k_y - S_{i,2} k_x k_z + S_{i,1} k_y k_z); \\
&\{R_{14}, R_{14}\}; c_1 S_{0,0} + S_{0,0} \frac{c_2+c_3+c_4}{3} k^2 + \frac{1}{2} S_{0,5} [c_3 (k_y^2 - k_x^2) + c_2 (k_x^2 - k_z^2) + c_4 (k_z^2 - k_y^2)] + \\
&\quad \frac{(c_3(k_x^2+k_y^2-2k_z^2)+c_2(k_x^2-2k_y^2+k_z^2)+c_4(-2k_x^2+k_y^2+k_z^2))}{2\sqrt{3}} S_{0,8} + c_5 (S_{0,7} k_x k_y + S_{0,6} k_x k_z + S_{0,4} k_y k_z) + \\
&\quad \sum_{i=1}^3 c_{i,1} (S_{i,3} k_x k_y - S_{i,2} k_x k_z + S_{i,1} k_y k_z); \\
&Z; \{R_9, R_9\}; \quad \Gamma_{0,0} (c_2 k_x + c_1) + k_y (c_4 \Gamma_{1,3} - c_5 \Gamma_{2,3} + c_3 \Gamma_{3,3}) - c_6 \Gamma_{0,2} k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Lambda; \{R_2, R_6\}, \{R_4, R_4\}; \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + \Gamma_{1,0} (c_4 q_x + c_5 q_y) + \Gamma_{2,3} (c_5 q_x - c_4 q_y) + (\alpha_1 \Gamma_{2,+} q_+ + h.c.) \\
&S; \{R_5, R_5\}, \{R_7, R_7\}; \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0} (c_{i,1} k_x + c_{i,2} k_z) + k_y (c_2 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,3} \Gamma_{2,i}); \\
&T; \{R_6, R_6\}, \{R_7, R_7\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_y (c_4 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,3} \Gamma_{2,i}); \\
&\{R_6, R_6\}, \{R_8, R_8\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_x (c_4 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,3} \Gamma_{2,i}); \\
&\{R_6, R_6\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z; \\
&\{R_7, R_7\}, \{R_8, R_8\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z; \\
&\{R_7, R_7\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_x (c_4 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,3} \Gamma_{2,i}); \\
&\{R_8, R_8\}, \{R_9, R_9\}; \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + k_y (c_4 \Gamma_{1,0} + \sum_{i=1}^3 c_{i,3} \Gamma_{2,i}); \\
&Z'; \{R_5, R_6\}, \{R_7, R_8\}; \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + k_x (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3});
\end{aligned}$$

SG 206

 $\Gamma_c^-; \{C_{31}^-|000\}, \{C_{2x}|\frac{1}{2}\frac{1}{2}0\}, \{\bar{C}_{2y}|0\frac{1}{2}\frac{1}{2}\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
 \Gamma; \{R_5, R_6\}; & \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
 & c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
 & \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
 \{R_{12}, R_{13}\}; & \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_x k_y - \frac{1+\sqrt{3}}{2} k_x k_z + k_y k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
 & c_3 \Gamma_{3,2} \left( \frac{1+\sqrt{3}}{2} k_x k_y - \frac{\sqrt{3}-1}{2} k_x k_z - k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
 & \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
 H; \{R_5, R_6\}; & \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_y k_z - \frac{1+\sqrt{3}}{2} k_x k_y + 2k_x k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
 & c_3 \Gamma_{3,2} \left( \frac{1-\sqrt{3}}{2} k_x k_y - k_x k_z + \frac{1+\sqrt{3}}{2} k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
 & \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
 \{R_{12}, R_{13}\}; & \Gamma_{0,0} (c_2 k^2 + c_1) + c_3 \Gamma_{0,1} \left( \frac{\sqrt{3}-1}{2} k_y k_z - \frac{1+\sqrt{3}}{2} k_x k_y + 2k_x k_z \right) + c_3 \Gamma_{0,3} (k_x k_y + k_x k_z + k_y k_z) + \\
 & c_3 \Gamma_{3,2} \left( \frac{1-\sqrt{3}}{2} k_x k_y - k_x k_z + \frac{1+\sqrt{3}}{2} k_y k_z \right) + [c_5 (2k_x^2 - k_y^2 - k_z^2) + c_4 (k_x^2 - 2k_y^2 + k_z^2)] \Gamma_{1,2} + \\
 & \sqrt{3} \Gamma_{2,2} [(c_4 + c_5) k_z^2 - c_4 k_x^2 - c_5 k_y^2]; \\
 P; \{R_7, R_7\}; & c_1 S_{0,0} + c_2 (S_{0,4} k_x + S_{0,6} k_y + S_{0,7} k_z) + \sum_{i=1}^3 c_{i,1} (S_{i,1} k_x - S_{i,2} k_y + S_{i,3} k_z); \\
 N; \{R_{10}, R_{10}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} k_z + \sum_{i=1}^3 \Gamma_{i,1} (c_{i,1} k_x + c_{i,2} k_y);
 \end{aligned}$$

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 Accidental degeneracies on high symmetry line

$$\begin{aligned}
 \Lambda; \{R_2, R_6\}, \{R_4, R_4\}; & \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + \Gamma_{1,0} (c_4 q_x + c_5 q_y) + \Gamma_{2,3} (c_5 q_x - c_4 q_y) + (\alpha_1 \Gamma_{2,+} q_+ + h.c.) \\
 D; \{R_5, R_5\}, \{R_7, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \Gamma_{1,0} (c_4 k_x + c_5 k_y) + \sum_{i=1}^3 \Gamma_{2,i} (c_{i,1} k_x + c_{i,2} k_y); \\
 F; \{R_7, R_7\}, \{R_9, R_{11}\}; & \Gamma_{0,0} (c_1 + c_2 p_z) + \Gamma_{3,0} c_3 p_z + \Gamma_{1,0} (c_4 p_x - c_5 p_y) + \Gamma_{2,3} (c_5 p_x + c_4 p_y) + (\alpha_1 \Gamma_{2,+} p_+ + h.c.)
 \end{aligned}$$

SG 207

 $\Gamma_c; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
 \Gamma; & R_4; c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z); \\
 & R_5; c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z); \\
 & R_8; c_1 \Gamma_{0,0} + (c_2 \Gamma_{3,3} + c_3 \Gamma_{3,0}) k_z + \left[ \left( \frac{\sqrt{3} \Gamma_{-,1} + \Gamma_{+,3}}{2} c_2 - c_3 \Gamma_{+,0} \right) k_+ + h.c. \right]; \\
 X; & R_6; c_2 (\sigma_3 k_x + \sigma_1 k_z) - c_3 \sigma_2 k_y + c_1 \sigma_0; \\
 & R_7; c_2 (\sigma_3 k_x - \sigma_1 k_z) - c_3 \sigma_2 k_y + c_1 \sigma_0; \\
 M; & R_6; c_2 (\sigma_1 k_x + \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
 & R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) - c_3 \sigma_2 k_z + c_1 \sigma_0; \\
 R; & R_4; c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z); \\
 & R_5; c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z); \\
 & R_8; c_1 \Gamma_{0,0} + (c_2 \Gamma_{3,3} + c_3 \Gamma_{3,0}) k_z + \left[ \left( \frac{\sqrt{3} \Gamma_{-,1} + \Gamma_{+,3}}{2} c_2 - c_3 \Gamma_{+,0} \right) k_+ + h.c. \right];
 \end{aligned}$$

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
&\{R_2\}, \{R_6\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_x^2 - c_2k_z^2 + ic_3k_xk_z) + h.c.]; \\
&\{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
&\{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
&\{R_4\}, \{R_8\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_x^2 - c_2k_z^2 + ic_3k_xk_z) + h.c.]; \\
&\{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_i c_{i,1}(k_x + k_y) + c_2\sigma_1(k_x - k_y) + c_3\sigma_2k_z; \\
&\Lambda; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + (\alpha_1\sigma_+q_+ + h.c.); \\
&\{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + (\alpha_1\sigma_+q_- + h.c.); \\
&\{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + (\alpha_1\sigma_+q_+ + h.c.); \\
&S; \{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_i c_{i,1}(k_x + k_z) + c_2\sigma_1(k_x - k_z) + c_3\sigma_2k_y; \\
&Z; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_x) + \sigma_3c_3k_x + c_4\sigma_1k_y + c_5\sigma_2k_z; \\
&T; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4[(\sigma_1 + \sigma_2)k_x + (\sigma_2 - \sigma_1)k_y]; \\
&\{R_2\}, \{R_6\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + \{\sigma_+[c_2k_xk_y + ic_3(k_x^2 - k_y^2)] + h.c.\}; \\
&\{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4[(\sigma_1 - \sigma_2)k_x - (\sigma_1 + \sigma_2)k_y]; \\
&\{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4[(\sigma_1 + \sigma_2)k_x + (\sigma_2 - \sigma_1)k_y]; \\
&\{R_4\}, \{R_8\}; \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_z + c_{i,2}k^2 + c_{i,3}k_z^2) + \{\sigma_+[c_2k_xk_y + ic_3(k_x^2 - k_y^2)] + h.c.\}; \\
&\{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4[(\sigma_1 + \sigma_2)k_x + (\sigma_2 - \sigma_1)k_y];
\end{aligned}$$

SG 208

 $\Gamma_c; \{C_{4x}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
&\Gamma; R_4; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
&R_5; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
&R_8; c_1\Gamma_{0,0} + (c_2\Gamma_{3,3} + c_3\Gamma_{3,0})k_z + \left[\left(\frac{\sqrt{3}\Gamma_{-,1} + \Gamma_{+,3}}{2}c_2 - c_3\Gamma_{+,0}\right)k_+ + h.c.\right]; \\
&X; R_6; c_2(\sigma_1k_x - \sigma_3k_z) - c_3\sigma_2k_y + c_1\sigma_0; \\
&R_7; c_2(\sigma_1k_x + \sigma_3k_z) - c_3\sigma_2k_y + c_1\sigma_0; \\
&M; R_6; c_2(\sigma_3k_x - \sigma_1k_y) - c_3\sigma_2k_z + c_1\sigma_0; \\
&R_7; c_2(\sigma_3k_x + \sigma_1k_y) - c_3\sigma_2k_z + c_1\sigma_0; \\
&R; R_4; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
&R_5; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
&R_8; c_1\Gamma_{0,0} + (c_2\Gamma_{3,3} + c_3\Gamma_{3,0})k_z + \left[\left(\frac{\sqrt{3}\Gamma_{-,1} + \Gamma_{+,3}}{2}c_2 - c_3\Gamma_{+,0}\right)k_+ + h.c.\right];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Delta; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4(\sigma_1 k_x - \sigma_2 k_z); \\
&\{R_2\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x^2 - c_2 k_z^2 + i c_3 k_x k_z) + h.c.]; \\
&\{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4(\sigma_1 k_x - \sigma_2 k_z); \\
&\{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4(\sigma_1 k_x - \sigma_2 k_z); \\
&\{R_4\}, \{R_8\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x^2 - c_2 k_z^2 + i c_3 k_x k_z) + h.c.]; \\
&\{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4(\sigma_1 k_x - \sigma_2 k_z); \\
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_x + k_y) + c_2 \sigma_1 (k_x - k_y) + c_3 \sigma_2 k_z; \\
&\Lambda; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
&\{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
&\{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
&S; \{R_5\}, \{R_7\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_x + k_z) + c_2 \sigma_1 (k_x - k_z) + c_3 \sigma_2 k_y; \\
&Z; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
&T; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4[(\sigma_1 + \sigma_2) k_x + (\sigma_2 - \sigma_1) k_y]; \\
&\{R_2\}, \{R_6\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + \{\sigma_+ [c_2 k_x k_y + i c_3 (k_x^2 - k_y^2)] + h.c.\}; \\
&\{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4[(\sigma_1 - \sigma_2) k_x - (\sigma_1 + \sigma_2) k_y]; \\
&\{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4[(\sigma_1 + \sigma_2) k_x + (\sigma_2 - \sigma_1) k_y]; \\
&\{R_4\}, \{R_8\}; \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_z + c_{i,2} k^2 + c_{i,3} k_z^2) + \{\sigma_+ [c_2 k_x k_y + i c_3 (k_x^2 - k_y^2)] + h.c.\}; \\
&\{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4[(\sigma_1 + \sigma_2) k_x + (\sigma_2 - \sigma_1) k_y];
\end{aligned}$$

SG 209

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 $\Gamma_c^f; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; \quad &R_4; \quad c_1 \sigma_0 + c_2(\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z); \\
&R_5; \quad c_1 \sigma_0 + c_2(\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z); \\
&R_8; \quad c_1 \Gamma_{0,0} + (c_2 \Gamma_{3,3} + c_3 \Gamma_{3,0}) k_z + \left[ \left( \frac{\sqrt{3} \Gamma_{-,1} + \Gamma_{+,3}}{2} c_2 - c_3 \Gamma_{+,0} \right) k_+ + h.c. \right]; \\
X; \quad &R_6; \quad c_2(\sigma_3 k_x + \sigma_1 k_z) + c_3 \sigma_2 k_y + c_1 \sigma_0; \\
&R_7; \quad c_2(\sigma_3 k_x - \sigma_1 k_z) + c_3 \sigma_2 k_y + c_1 \sigma_0; \\
L; \quad &\{R_3, R_4\}; (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + c_4 \sigma_3 q_y (q_y^2 - 3 q_x^2) + \{\sigma_+ [\alpha_1 q_z + \alpha_2 q_x (q_x^2 - 3 q_y^2) + \alpha_3 q_z (q_x^2 + q_y^2) + \alpha_4 q_z^3] + h.c.\}; \\
&R_6; \quad c_1 \sigma_0 + c_2 \sigma_2 q_z + c_3(\sigma_3 q_y - \sigma_1 q_x); \\
W; \quad &R_5; \quad c_1 \sigma_0 + c_2[\sigma_3(k_y - k_z) - \sigma_1(k_y + k_z)] + c_3 \sigma_2 k_x;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_2\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x^2 - c_2 k_z^2 + i c_3 k_x k_z) + h.c.]; \\
\{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_4\}, \{R_8\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x^2 - c_2 k_z^2 + i c_3 k_x k_z) + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_x + k_y) + c_2 \sigma_1 (k_x - k_y) + c_3 \sigma_2 k_z; \\
S; \{R_2\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_x + k_z) + c_2 \sigma_1 (k_x - k_z) + c_3 \sigma_2 k_y; \\
Z; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
Q; \{R_2\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_y - k_z) + \sum_{i=1}^2 \sigma_i [c_{i,2} k_x + c_{i,3} (k_y + k_z)];
\end{aligned}$$

SG 210

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 $\Gamma_c^f; \{C_{4x}^+ | \frac{1}{4} \frac{1}{4} \frac{1}{4}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{4} \frac{1}{4} \frac{1}{4}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_4; & c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z); \\
R_5; & c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z); \\
R_8; & c_1 \Gamma_{0,0} + (c_2 \Gamma_{3,3} + c_3 \Gamma_{3,0}) k_z + \left[ \left( \frac{\sqrt{3} \Gamma_{-,1} + \Gamma_{+,3}}{2} c_2 - c_3 \Gamma_{+,0} \right) k_+ + h.c. \right]; \\
X; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_z) + c_3 \sigma_2 k_y + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_z) + c_3 \sigma_2 k_y + c_1 \sigma_0; \\
L; \{R_3, R_4\}; & (c_1 + c_2 q^2 + c_3 q_z^2) \sigma_0 + c_4 \sigma_3 q_y (q_y^2 - 3 q_z^2) + \{ \sigma_+ [\alpha_1 q_z + \alpha_2 q_x (q_x^2 - 3 q_y^2) + \alpha_3 q_z (q_x^2 + q_y^2) + \alpha_4 q_z^3] + h.c. \}; \\
R_6; & c_1 \sigma_0 + c_2 \sigma_2 q_z + c_3 (\sigma_3 q_y - \sigma_1 q_x); \\
W; \{R_1, R_3\}; & (c_1 + c_2 k^2 + c_3 k_x^2) \sigma_0 + c_4 \sigma_3 k_y k_z + \{ [\alpha_1 k_x + \alpha_2 (k_y^2 - k_z^2)] \sigma_+ + h.c. \};
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_2\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x^2 - c_2 k_z^2 + i c_3 k_x k_z) + h.c.]; \\
\{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_4\}, \{R_8\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x^2 - c_2 k_z^2 + i c_3 k_x k_z) + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_x + k_y) + c_2 \sigma_1 (k_x - k_y) + c_3 \sigma_2 k_z; \\
S; \{R_5\}, \{R_7\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_x + k_z) + c_2 \sigma_1 (k_x - k_z) + c_3 \sigma_2 k_y; \\
Z; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z; \\
Q; \{R_{10}\}, \{R_{14}\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_y - k_z) + \sum_{i=1}^2 \sigma_i [c_{i,2} k_x + c_{i,3} (k_y + k_z)];
\end{aligned}$$

SG 211

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 $\Gamma_c^v; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
&\Gamma; R_4; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
&\quad R_5; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
&\quad R_8; c_1\Gamma_{0,0} + (c_2\Gamma_{3,3} + c_3\Gamma_{3,0})k_z + \left[\left(\frac{\sqrt{3}\Gamma_{-,1} + \Gamma_{+,3}}{2}c_2 - c_3\Gamma_{+,0}\right)k_+ + h.c.\right]; \\
&H; R_4; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
&\quad R_5; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
&\quad R_8; c_1\Gamma_{0,0} + (c_2\Gamma_{3,3} + c_3\Gamma_{3,0})k_z + \left[\left(\frac{\sqrt{3}\Gamma_{-,1} + \Gamma_{+,3}}{2}c_2 - c_3\Gamma_{+,0}\right)k_+ + h.c.\right]; \\
&P; R_4; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
&\quad R_5; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
&\quad R_6; c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
&N; R_5; c_1\sigma_0 + c_2\sigma_3(k_x + k_y) + c_3\sigma_1(k_x - k_y) + c_4\sigma_2k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
&\Sigma; \{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i c_{i,1}(k_x + k_y) + c_2\sigma_1(k_x - k_y) + c_3\sigma_2k_z; \\
&\Delta; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_x^2 - c_2k_z^2 + ic_3k_xk_z) + h.c.]; \\
&\quad \{R_2\}, \{R_8\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
&\quad \{R_4\}, \{R_8\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_x^2 - c_2k_z^2 + ic_3k_xk_z) + h.c.]; \\
&\quad \{R_6\}, \{R_8\}; \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
&\Lambda; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + (\alpha_1\sigma_+q_+ + h.c.); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + (\alpha_1\sigma_+q_- + h.c.); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + (\alpha_1\sigma_+q_+ + h.c.); \\
&D; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2k_z) + \sigma_3c_3k_z + c_4\sigma_1(k_x - k_y) + c_5\sigma_2(k_x + k_y); \\
&G; \{R_2\}, \{R_4\}; \sigma_0c_1 + \sum_{i=0,3}\sigma_i c_{i,1}(k_x - k_y) + c_2\sigma_1(k_x + k_y) + c_3\sigma_2k_z; \\
&F; \{R_2\}, \{R_4\}; \sigma_0(c_1 + c_2p_z) + \sigma_3c_3p_z + (\alpha_1\sigma_+p_- + h.c.); \\
&\quad \{R_2\}, \{R_6\}; \sigma_0(c_1 + c_2p_z) + \sigma_3c_3p_z + (\alpha_1\sigma_+p_+ + h.c.); \\
&\quad \{R_4\}, \{R_6\}; \sigma_0(c_1 + c_2p_z) + \sigma_3c_3p_z + (\alpha_1\sigma_+p_- + h.c.);
\end{aligned}$$



$\Gamma_c; \{C_{4x}^+ | \frac{3}{4} \frac{3}{4} \frac{1}{4}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{4} \frac{1}{4} \frac{1}{4}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$

$$\begin{aligned}
\Gamma; \quad R_4; & \quad c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z); \\
R_5; & \quad c_1 \sigma_0 + c_2 (\sigma_1 k_x - \sigma_2 k_y - \sigma_3 k_z); \\
R_8; & \quad c_1 \Gamma_{0,0} + (c_2 \Gamma_{3,3} + c_3 \Gamma_{3,0}) k_z + \left[ \left( \frac{\sqrt{3} \Gamma_{-,1} + \Gamma_{+,3}}{2} c_2 - c_3 \Gamma_{+,0} \right) k_+ + h.c. \right]; \\
X; \quad \{R_8, R_{10}\}; & \quad c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_y; \\
\{R_9, R_{11}\}; & \quad c_1 \sigma_0 + (c_2 \sigma_1 + c_3 \sigma_2) k_y; \\
R_{14}; & \quad c_1 \sigma_0 + c_2 \sigma_3 k_y; \\
M; \quad \{R_6, R_7\}; & \quad c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,3} k_x + \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z + [\alpha_1 (i k_x \Gamma_{+,0} + k_y \Gamma_{+,1}) + h.c.]; \\
R; \quad \{R_3, R_4\}; & \quad (c_1 + c_2 k^2) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_x k_y k_z; \\
R_8; & \quad (c_1 + c_2 k^2) \sigma_0 + c_3 \sigma_3 k_x k_y k_z; \\
\{R_{13}, R_{14}\}; & \quad c_1 S_{0,0} + c_2 (S_{0,2} k_x + S_{0,3} k_y - S_{0,1} k_z) + \sum_{i=1}^2 c_{i,1} (S_{i,6} k_x - S_{i,7} k_y + S_{i,4} k_z); \\
S; \quad \{R_{10}, R_{14}\}; & \quad (c_1 + c_2 k_x + c_2 k_z) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
Z; \quad \{R_5, R_7\}; & \quad (c_1 + c_2 k_x) \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) k_y; \\
T; \quad \{R_{10}, R_{14}\}; & \quad (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) \sigma_0 + (c_5 \sigma_1 + c_6 \sigma_2) k_x k_y; \\
\{R_{12}, R_{16}\}; & \quad (c_1 + c_2 k_z + c_3 k^2 + c_4 k_z^2) \sigma_0 + (c_5 \sigma_1 + c_6 \sigma_2) k_x k_y;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_2\}, \{R_6\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x^2 - c_2 k_z^2 + i c_3 k_x k_z) + h.c.]; \\
\{R_2\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_4\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_4\}, \{R_8\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x^2 - c_2 k_z^2 + i c_3 k_x k_z) + h.c.]; \\
\{R_6\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\Sigma; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_x + k_y) + c_2 \sigma_1 (k_x - k_y) + c_3 \sigma_2 k_z; \\
\Lambda; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
\{R_2\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
\{R_4\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
T; \quad \{R_{10}, R_{14}\}, \{R_{12}, R_{16}\}; & \quad \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + \\
& \quad [(c_4 \Gamma_{2,0} + c_5 \Gamma_{1,3} - \alpha_1 \Gamma_{2,+}) (k_x + k_y) + (c_4 \Gamma_{1,0} - c_5 \Gamma_{2,3} + \alpha_1 \Gamma_{1,+}) (k_x - k_y) + h.c.];
\end{aligned}$$

SG 213

 $\Gamma_c; \{C_{4x}^+ | \frac{1}{4} \frac{1}{4} \frac{3}{4}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{3}{4} \frac{3}{4} \frac{3}{4}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \quad R_4; & \quad c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
R_5; & \quad c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
R_8; & \quad c_1\Gamma_{0,0} + (c_2\Gamma_{3,3} + c_3\Gamma_{3,0})k_z + \left[\left(\frac{\sqrt{3}\Gamma_{-,1}+\Gamma_{+,3}}{2}c_2 - c_3\Gamma_{+,0}\right)k_+ + h.c.\right]; \\
X; \quad \{R_8, R_{10}\}; & \quad c_1\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_y; \\
\{R_9, R_{11}\}; & \quad c_1\sigma_0 + (c_2\sigma_1 + c_3\sigma_2)k_y; \\
R_{14}; & \quad c_1\sigma_0 + c_2\sigma_3k_y; \\
M; \quad \{R_6, R_7\}; & \quad c_1\Gamma_{0,0} + c_2(\Gamma_{3,3}k_x + \Gamma_{0,2}k_y) + c_3\Gamma_{3,1}k_z + [\alpha_1(ik_x\Gamma_{+,0} + k_y\Gamma_{+,1}) + h.c.]; \\
R; \quad \{R_3, R_4\}; & \quad (c_1 + c_2k^2)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_xk_yk_z; \\
R_8; & \quad (c_1 + c_2k^2)\sigma_0 + c_3\sigma_3k_xk_yk_z; \\
\{R_{13}, R_{14}\}; & \quad c_1S_{0,0} + c_2(S_{0,2}k_x + S_{0,3}k_y - S_{0,1}k_z) + \sum_{i=1}^2 c_{i,1}(S_{i,6}k_x - S_{i,7}k_y + S_{i,4}k_z); \\
S; \quad \{R_{12}, R_{16}\}; & \quad (c_1 + c_2k_x + c_2k_z)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
Z; \quad \{R_5, R_7\}; & \quad (c_1 + c_2k_x)\sigma_0 + (c_3\sigma_1 + c_4\sigma_2)k_y; \\
T; \quad \{R_{10}, R_{14}\}; & \quad (c_1 + c_2k_z + c_3k^2 + c_4k_z^2)\sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y; \\
\{R_{12}, R_{16}\}; & \quad (c_1 + c_2k_z + c_3k^2 + c_4k_z^2)\sigma_0 + (c_5\sigma_1 + c_6\sigma_2)k_xk_y;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
\{R_2\}, \{R_6\}; & \quad \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_x^2 - c_2k_z^2 + ic_3k_xk_z) + h.c.]; \\
\{R_2\}, \{R_8\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
\{R_4\}, \{R_6\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
\{R_4\}, \{R_8\}; & \quad \sigma_0c_1 + \sum_{i=0,3} \sigma_i(c_{i,1}k_y + c_{i,2}k^2 + c_{i,3}k_y^2) + [\sigma_+(c_2k_x^2 - c_2k_z^2 + ic_3k_xk_z) + h.c.]; \\
\{R_6\}, \{R_8\}; & \quad \sigma_0(c_1 + c_2k_y) + \sigma_3c_3k_y + c_4(\sigma_1k_x - \sigma_2k_z); \\
\Sigma; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0c_1 + \sum_{i=0,3} \sigma_i c_{i,1}(k_x + k_y) + c_2\sigma_1(k_x - k_y) + c_3\sigma_2k_z; \\
\Lambda; \quad \{R_2\}, \{R_4\}; & \quad \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + (\alpha_1\sigma_+q_+ + h.c.); \\
\{R_2\}, \{R_6\}; & \quad \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + (\alpha_1\sigma_+q_- + h.c.); \\
\{R_4\}, \{R_6\}; & \quad \sigma_0(c_1 + c_2q_z) + \sigma_3c_3q_z + (\alpha_1\sigma_+q_+ + h.c.); \\
T; \quad \{R_{10}, R_{14}\}, \{R_{12}, R_{16}\}; & \quad \Gamma_{0,0}(c_1 + c_2k_z) + \Gamma_{3,0}c_3k_z + \\
& \quad [(c_4\Gamma_{2,0} + c_5\Gamma_{1,3} - \alpha_1\Gamma_{2,+})(k_x + k_y) + (c_4\Gamma_{1,0} - c_5\Gamma_{2,3} + \alpha_1\Gamma_{1,+})(k_x - k_y) + h.c.];
\end{aligned}$$

SG 214

 $\Gamma_c^v; \{C_{4x}^+ | 00 \frac{1}{2}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; \quad R_4; & \quad c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
R_5; & \quad c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
R_8; & \quad c_1\Gamma_{0,0} + (c_2\Gamma_{3,3} + c_3\Gamma_{3,0})k_z + \left[\left(\frac{\sqrt{3}\Gamma_{-,1}+\Gamma_{+,3}}{2}c_2 - c_3\Gamma_{+,0}\right)k_+ + h.c.\right]; \\
H; \quad R_4; & \quad c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
R_5; & \quad c_1\sigma_0 + c_2(\sigma_1k_x - \sigma_2k_y - \sigma_3k_z); \\
R_8; & \quad c_1\Gamma_{0,0} + (c_2\Gamma_{3,3} + c_3\Gamma_{3,0})k_z + \left[\left(\frac{\sqrt{3}\Gamma_{-,1}+\Gamma_{+,3}}{2}c_2 - c_3\Gamma_{+,0}\right)k_+ + h.c.\right]; \\
P; \quad R_7; & \quad c_1A_0 + c_2(A_1k_x - A_2k_y + A_3k_z) + A_4c_3k_x + c_4(A_6k_y + A_7k_z); \\
N; \quad R_5; & \quad c_1\sigma_0 + c_2\sigma_1(k_x - k_y) + c_3\sigma_2(k_x + k_y) + c_4\sigma_3k_z;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i c_{i,1} (k_x + k_y) + c_2 \sigma_1 (k_x - k_y) + c_3 \sigma_2 k_z; \\
\Delta; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_2\}, \{R_6\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x^2 - c_2 k_z^2 + i c_3 k_x k_z) + h.c.]; \\
\{R_2\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\{R_4\}, \{R_8\}; & \sigma_0 c_1 + \sum_{i=0,3} \sigma_i (c_{i,1} k_y + c_{i,2} k^2 + c_{i,3} k_y^2) + [\sigma_+ (c_2 k_x^2 - c_2 k_z^2 + i c_3 k_x k_z) + h.c.]; \\
\{R_6\}, \{R_8\}; & \sigma_0 (c_1 + c_2 k_y) + \sigma_3 c_3 k_y + c_4 (\sigma_1 k_x - \sigma_2 k_z); \\
\Lambda; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
\{R_2\}, \{R_6\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_- + h.c.); \\
\{R_4\}, \{R_6\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z + (\alpha_1 \sigma_+ q_+ + h.c.); \\
D; \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + c_4 \sigma_1 (k_x - k_y) + c_5 \sigma_2 (k_x + k_y); \\
G; \{R_5\}, \{R_7\}; & \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 c_3 (k_x - k_y) + c_4 \sigma_1 (k_x + k_y) + c_5 \sigma_2 k_z; \\
F; \{R_7\}, \{R_{11}\}; & \sigma_0 (c_1 + c_2 p_z) + \sigma_3 c_3 p_z + (\alpha_1 \sigma_+ p_+ + h.c.); \\
\{R_7\}, \{R_9\}; & \sigma_0 (c_1 + c_2 p_z) + \sigma_3 c_3 p_z + (\alpha_1 \sigma_+ p_- + h.c.); \\
\{R_9\}, \{R_{11}\}; & \sigma_0 (c_1 + c_2 p_z) + \sigma_3 c_3 p_z + (\alpha_1 \sigma_+ p_- + h.c.);
\end{aligned}$$

SG 215

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 $\Gamma_c; \{S_{4x}^-|000\}, \{\bar{C}_{31}^-|000\}, \{\sigma_{db}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; & R_4; (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
& R_5; (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
& R_8; c_1 \Gamma_{0,0} + c_2 [(\Gamma_{1,1} - \sqrt{3} \Gamma_{1,3}) k_x - (\Gamma_{2,1} + \sqrt{3} \Gamma_{2,3}) k_y + 2 \Gamma_{3,1} k_z]; \\
X; & R_6; c_2 (\sigma_3 k_x + \sigma_1 k_z) + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_3 k_x - \sigma_1 k_z) + c_1 \sigma_0; \\
M; & R_6; c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
& R_7; c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
R; & R_4; (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
& R_5; (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
& R_8; c_1 \Gamma_{0,0} + c_2 [(\Gamma_{1,1} - \sqrt{3} \Gamma_{1,3}) k_x - (\Gamma_{2,1} + \sqrt{3} \Gamma_{2,3}) k_y + 2 \Gamma_{3,1} k_z]; \\
\Delta; & R_5; (c_1 + c_2 k_y) \sigma_0 + c_3 [(k_x + k_z) \sigma_3 - (k_x - k_z) \sigma_1]; \\
\Lambda; & R_6; [c_1 + c_2 (k_x + k_y + k_z)] \sigma_0 + c_3 \sigma_1 (k_y - k_x) - \frac{c_3 \sigma_3 (k_x + k_y - 2 k_z)}{\sqrt{3}}; \\
T; & R_5; (c_1 + c_2 k_z) \sigma_0 + c_3 [(k_x + k_y) \sigma_3 + (k_x - k_y) \sigma_1];
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 (k_x - k_y); \\
\Lambda; \{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
\{R_3\}, \{R_6\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + (A_6 c_4 + 2 A_7 c_5 - A_2 c_6) q_y + [A_4 c_4 + (A_5 - \sqrt{3} A_8) c_5 - A_1 c_6] q_x; \\
\{R_4\}, \{R_6\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z - [A_6 c_4 - (A_5 - \sqrt{3} A_8) c_5 - A_2 c_6] q_x + (A_4 c_4 + 2 A_7 c_5 - A_1 c_6) q_y; \\
S; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_z) + \sigma_3 c_3 (k_x + k_z) + c_4 \sigma_2 (k_z - k_x); \\
Z; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z;
\end{aligned}$$

## SG 216

$\Gamma_c^f; \{S_{4x}^-|000\}, \{\bar{C}_{31}^-|000\}, \{\sigma_{db}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_4; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_5; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_8; & c_1 \Gamma_{0,0} + c_2 [(\Gamma_{1,1} - \sqrt{3} \Gamma_{1,3}) k_x - (\Gamma_{2,1} + \sqrt{3} \Gamma_{2,3}) k_y + 2 \Gamma_{3,1} k_z]; \\
X; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_z) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x + \sigma_3 k_z) + c_1 \sigma_0; \\
L; \{R_3, R_4\}; & c_2 \sigma_3 (k_x + k_y + k_z) + c_1 \sigma_0; \\
R_6; & c_2 \left[ \sigma_1 (k_y - k_x) + \frac{(k_x + k_y - 2k_z)}{\sqrt{3}} \sigma_3 \right] + c_1 \sigma_0; \\
\Delta; R_5; & (c_1 + c_2 k_y) \sigma_0 + c_3 [(k_x + k_z) \sigma_3 - (k_x - k_z) \sigma_1]; \\
\Lambda; R_6; & [c_1 + c_2 (k_x + k_y + k_z)] \sigma_0 + c_3 \sigma_1 (k_y - k_x) - \frac{c_3 \sigma_3 (k_x + k_y - 2k_z)}{\sqrt{3}};
\end{aligned}$$

## Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
\{R_3\}, \{R_6\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + (A_6 c_4 + 2 A_7 c_5 - A_2 c_6) q_y + [A_4 c_4 + (A_5 - \sqrt{3} A_8) c_5 - A_1 c_6] q_x; \\
\{R_4\}, \{R_6\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z - [A_6 c_4 - (A_5 - \sqrt{3} A_8) c_5 - A_2 c_6] q_x + (A_4 c_4 + 2 A_7 c_5 - A_1 c_6) q_y; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 (k_x - k_y); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_z) + \sigma_3 c_3 (k_x + k_z) + c_4 \sigma_2 (k_z - k_x); \\
Z; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z;
\end{aligned}$$

## SG 217

$\Gamma_c^v; \{S_{4x}^-|000\}, \{\bar{C}_{31}^-|000\}, \{\sigma_{db}|000\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_4; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_5; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_8; & c_1 \Gamma_{0,0} + c_2 [(\Gamma_{1,1} - \sqrt{3} \Gamma_{1,3}) k_x - (\Gamma_{2,1} + \sqrt{3} \Gamma_{2,3}) k_y + 2 \Gamma_{3,1} k_z]; \\
H; R_4; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_5; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_8; & c_1 \Gamma_{0,0} + c_2 [(\Gamma_{1,1} - \sqrt{3} \Gamma_{1,3}) k_x - (\Gamma_{2,1} + \sqrt{3} \Gamma_{2,3}) k_y + 2 \Gamma_{3,1} k_z]; \\
P; R_4; & (c_1 + c_2 k^2 + c_3 k_x k_y k_z) \sigma_0 + c_4 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_5; & (c_1 + c_2 k^2 + c_3 k_x k_y k_z) \sigma_0 + c_4 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_8; & c_1 \Gamma_{0,0} + c_2 [(\Gamma_{1,1} - \sqrt{3} \Gamma_{1,3}) k_x - (\Gamma_{2,1} + \sqrt{3} \Gamma_{2,3}) k_y + 2 \Gamma_{3,1} k_z] + c_3 (\Gamma_{1,2} k_x - \Gamma_{2,2} k_y - \Gamma_{3,2} k_z); \\
N; R_5; & c_3 \sigma_1 (k_x + k_y) + c_2 \sigma_3 (k_x - k_y) + c_1 \sigma_0; \\
\Delta; R_5; & c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_z] + \sigma_0 (c_3 k_y + c_1); \\
\Lambda; R_6; & [c_1 + c_2 (k_x + k_y + k_z)] \sigma_0 + c_3 \sigma_1 (k_y - k_x) - \frac{c_3 \sigma_3 (k_x + k_y - 2k_z)}{\sqrt{3}}; \\
D; R_5; & c_3 \sigma_1 (k_x + k_y) + c_2 \sigma_3 (k_x - k_y) + \sigma_0 (c_4 k_z + c_1); \\
F; R_6; & [c_1 + c_2 (k_x - k_y + k_z)] \sigma_0 + c_3 \sigma_1 (k_y + k_x) + \frac{c_3 \sigma_3 (-k_x + k_y + 2k_z)}{\sqrt{3}};
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 (k_x - k_y); \\
\Lambda; \{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
& \{R_3\}, \{R_6\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + (A_6 c_4 + 2 A_7 c_5 - A_2 c_6) q_y + [A_4 c_4 + (A_5 - \sqrt{3} A_8) c_5 - A_1 c_6] q_x; \\
& \{R_4\}, \{R_6\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z - [A_6 c_4 - (A_5 - \sqrt{3} A_8) c_5 - A_2 c_6] q_x + (A_4 c_4 + 2 A_7 c_5 - A_1 c_6) q_y; \\
G; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x - c_2 k_y) + \sigma_3 c_3 (k_x - k_y) + c_4 \sigma_1 (k_x + k_y); \\
F; \{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 p_z) + \sigma_3 c_3 p_z; \\
& \{R_3\}, \{R_6\}; A_0 (c_1 + c_2 p_z) + (\sqrt{3} A_5 + A_8) c_3 p_z + (A_6 c_4 + 2 A_7 c_5 - A_2 c_6) (\sqrt{3} p_x - p_y) + \\
& [A_4 c_4 + (A_5 - \sqrt{3} A_8) c_5 - A_1 c_6] (p_x + \sqrt{3} p_y); \\
& \{R_4\}, \{R_6\}; A_0 (c_1 + c_2 p_z) + (\sqrt{3} A_5 + A_8) c_3 p_z + (A_4 c_4 + 2 A_7 c_5 - A_1 c_6) (\sqrt{3} p_x - p_y) - \\
& [A_6 c_4 - (A_5 - \sqrt{3} A_8) c_5 - A_2 c_6] (p_x + \sqrt{3} p_y);
\end{aligned}$$

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SG 218

$\Gamma_c; \{S_{4x}^- | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\bar{C}_{31}^- | 000\}, \{\sigma_{db} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Non-Centrosymmetric; with SOC

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$$\begin{aligned}
\Gamma; R_4; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_5; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_8; & c_1 \Gamma_{0,0} + c_2 [(\Gamma_{1,1} - \sqrt{3} \Gamma_{1,3}) k_x - (\Gamma_{2,1} + \sqrt{3} \Gamma_{2,3}) k_y + 2 \Gamma_{3,1} k_z]; \\
X; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + (c_2 \Gamma_{0,2} + c_3 \Gamma_{2,1} + c_4 \Gamma_{1,1}) (k_x + k_z) + (c_2 \Gamma_{3,3} + c_3 \Gamma_{1,0} - c_4 \Gamma_{2,0}) (k_x - k_z) + k_y (c_5 \Gamma_{1,3} + c_6 \Gamma_{2,3}); \\
M; R_6; & c_2 (\sigma_1 k_x + \sigma_3 k_y) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x - \sigma_3 k_y) + c_1 \sigma_0; \\
R; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{1,0} q_x + \Gamma_{2,3} q_y + \Gamma_{2,1} q_z) + c_3 [(\sqrt{3} \Gamma_{1,0} - \Gamma_{2,0}) q_x + (\Gamma_{1,3} + \sqrt{3} \Gamma_{2,3}) q_y + (\Gamma_{1,1} + \sqrt{3} \Gamma_{2,1}) q_z]; \\
\{R_{15}, R_{15}\}; & c_1 Q_{0,0,0} + \sqrt{2} (2 c_2 Q_{3,1,3} - c_3 Q_{3,2,3} + 2 c_4 Q_{1,1,3} - c_5 Q_{2,2,3} - c_6 Q_{1,2,3} - 2 c_7 Q_{2,1,3}) k_z + \\
& [c_2 (\sqrt{3} Q_{3,3,2} + Q_{3,1,1}) + c_3 Q_{3,2,1} + c_4 (\sqrt{3} Q_{1,3,2} + Q_{1,1,1}) + c_5 Q_{2,2,1} + c_6 Q_{1,2,1} - c_7 (\sqrt{3} Q_{2,3,2} + Q_{2,1,1})] (k_x - k_y) + \\
& [c_2 (\sqrt{3} Q_{3,0,3} - Q_{3,2,0}) + c_3 Q_{3,1,0} + c_4 (\sqrt{3} Q_{1,0,3} - Q_{1,2,0}) + c_5 Q_{2,1,0} + c_6 Q_{1,1,0} - c_7 (\sqrt{3} Q_{2,0,3} - Q_{2,2,0})] (k_x + k_y); \\
\Delta; R_5; & c_2 [(\sigma_3 - \sigma_1) k_x + (\sigma_1 + \sigma_3) k_z] + \sigma_0 (c_3 k_y + c_1); \\
\Lambda; R_6; & [c_1 + c_2 (k_x + k_y + k_z)] \sigma_0 + c_3 \sigma_1 (k_y - k_x) - \frac{c_3 \sigma_3 (k_x + k_y - 2 k_z)}{\sqrt{3}}; \\
S; \{R_2, R_4\}; & [c_1 + c_2 (k_x + k_z)] \sigma_0 + (c_3 \sigma_1 - c_4 \sigma_2) (k_x - k_z) + c_5 \sigma_3 k_y; \\
T; R_5; & c_2 [(\sigma_3 - \sigma_1) k_x + (\sigma_1 + \sigma_3) k_y] + \sigma_0 (c_3 k_z + c_1);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 (k_x - k_y); \\
\Lambda; \{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
& \{R_3\}, \{R_6\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + (A_6 c_4 + 2 A_7 c_5 - A_2 c_6) q_y + [A_4 c_4 + (A_5 - \sqrt{3} A_8) c_5 - A_1 c_6] q_x; \\
& \{R_4\}, \{R_6\}; A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z - [A_6 c_4 - (A_5 - \sqrt{3} A_8) c_5 - A_2 c_6] q_x + (A_4 c_4 + 2 A_7 c_5 - A_1 c_6) q_y; \\
Z; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z;
\end{aligned}$$

SG 219

 $\Gamma_c^f; \{S_{4x}^- | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\bar{C}_{31}^- | 000\}, \{\sigma_{db} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_4; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_5; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_8; & c_1 \Gamma_{0,0} + c_2 [(\Gamma_{1,1} - \sqrt{3} \Gamma_{1,3}) k_x - (\Gamma_{2,1} + \sqrt{3} \Gamma_{2,3}) k_y + 2 \Gamma_{3,1} k_z]; \\
X; R_6; & c_2 (\sigma_1 k_x - \sigma_3 k_z) + c_1 \sigma_0; \\
R_7; & c_2 (\sigma_1 k_x + \sigma_3 k_z) + c_1 \sigma_0; \\
L; \{R_1, R_1\}; & (c_3 \sigma_1 - c_4 \sigma_2 + c_2 \sigma_3) q_z + c_1 \sigma_0; \\
\{R_2, R_2\}; & (c_3 \sigma_1 - c_4 \sigma_2 + c_2 \sigma_3) q_z + c_1 \sigma_0; \\
\{R_5, R_5\}; & c_1 \Gamma_{0,0} + \sum_{i=1}^3 [c_{i,1} \Gamma_{i,0} q_z + c_{i,2} (\Gamma_{i,3} q_x - \Gamma_{i,1} q_y)]; \\
W; \{R_2, R_6\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_x + c_1 \sigma_0; \\
\{R_4, R_8\}; & (c_2 \sigma_1 - c_3 \sigma_2) k_x + c_1 \sigma_0; \\
\Delta; R_5; & c_2 [(\sigma_3 - \sigma_1) k_x + (\sigma_1 + \sigma_3) k_z] + \sigma_0 (c_3 k_y + c_1); \\
\Lambda; R_6; & [c_1 + c_2 (k_x + k_y + k_z)] \sigma_0 + c_3 \sigma_1 (k_y - k_x) - \frac{c_3 \sigma_3 (k_x + k_y - 2k_z)}{\sqrt{3}}; \\
Q; \{R_2, R_2\}; & [c_1 + c_2 (k_y - k_z)] \sigma_0 + \sum_{i=1}^3 [c_{i,1} k_x + c_{i,2} (k_y + k_z)] \sigma_i;
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Lambda; \{R_3\}, \{R_4\}; & \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
\{R_3\}, \{R_6\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + (A_6 c_4 + 2 A_7 c_5 - A_2 c_6) q_y + [A_4 c_4 + (A_5 - \sqrt{3} A_8) c_5 - A_1 c_6] q_x; \\
\{R_4\}, \{R_6\}; & A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z - [A_6 c_4 - (A_5 - \sqrt{3} A_8) c_5 - A_2 c_6] q_x + (A_4 c_4 + 2 A_7 c_5 - A_1 c_6) q_y; \\
\Sigma; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 (k_x - k_y); \\
S; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x + c_2 k_z) + \sigma_3 c_3 (k_x + k_z) + c_4 \sigma_2 (k_z - k_x); \\
Z; \{R_2\}, \{R_4\}; & \sigma_0 (c_1 + c_2 k_x) + \sigma_3 c_3 k_x + c_4 \sigma_1 k_y + c_5 \sigma_2 k_z;
\end{aligned}$$

SG 220

 $\Gamma_c^v; \{S_{4x}^- | \frac{1}{2} 00\}, \{\bar{C}_{31}^- | 000\}, \{\sigma_{db} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T}; \text{Non-Centrosymmetric; with SOC}$ 

$$\begin{aligned}
\Gamma; R_4; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_5; & (c_1 + c_2 k^2) \sigma_0 + c_3 [\sigma_1 k_x (k_y^2 - k_z^2) + \sigma_2 k_y (k_x^2 - k_z^2) + \sigma_3 k_z (k_y^2 - k_x^2)]; \\
R_8; & c_1 \Gamma_{0,0} + c_2 [(\Gamma_{1,1} - \sqrt{3} \Gamma_{1,3}) k_x - (\Gamma_{2,1} + \sqrt{3} \Gamma_{2,3}) k_y + 2 \Gamma_{3,1} k_z]; \\
H; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{1,0} q_x + \Gamma_{2,3} q_y + \Gamma_{2,1} q_z) + c_3 [(\sqrt{3} \Gamma_{1,0} - \Gamma_{2,0}) q_x + (\Gamma_{1,3} + \sqrt{3} \Gamma_{2,3}) q_y + (\Gamma_{1,1} + \sqrt{3} \Gamma_{2,1}) q_z]; \\
\{R_{15}, R_{15}\}; & c_1 Q_{0,0,0} + \sqrt{2} (2 c_2 Q_{3,1,3} - c_3 Q_{3,2,3} + 2 c_4 Q_{1,1,3} - c_5 Q_{2,2,3} - c_6 Q_{1,2,3} - 2 c_7 Q_{2,1,3}) k_z + \\
& [c_2 (\sqrt{3} Q_{3,3,2} + Q_{3,1,1}) + c_3 Q_{3,2,1} + c_4 (\sqrt{3} Q_{1,3,2} + Q_{1,1,1}) + c_5 Q_{2,2,1} + c_6 Q_{1,2,1} - c_7 (\sqrt{3} Q_{2,3,2} + Q_{2,1,1})] (k_x - k_y) + \\
& [c_2 (\sqrt{3} Q_{3,0,3} - Q_{3,2,0}) + c_3 Q_{3,1,0} + c_4 (\sqrt{3} Q_{1,0,3} - Q_{1,2,0}) + c_5 Q_{2,1,0} + c_6 Q_{1,1,0} - c_7 (\sqrt{3} Q_{2,0,3} - Q_{2,2,0})] (k_x + k_y); \\
P; R_{21}; & (c_1 + c_2 k^2) \sigma_0 + c_3 \sigma_1 (2 k_x^2 - k_y^2 - k_z^2) + \sqrt{3} c_3 \sigma_2 (k_y^2 - k_z^2); \\
R_{27}; & c_2 (A_6 k_x + A_4 k_y - A_7 k_z) + A_0 c_1; \\
R_{28}; & c_2 (A_6 k_x + A_4 k_y - A_7 k_z) + A_0 c_1; \\
N; \{R_5, R_6\}; & (c_2 \sigma_1 - c_4 \sigma_2) (k_x + k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
\{R_7, R_8\}; & (c_2 \sigma_1 - c_4 \sigma_2) (k_x + k_y) + c_3 \sigma_3 k_z + c_1 \sigma_0; \\
\Delta; R_5; & c_2 [(\sigma_1 + \sigma_3) k_x + (\sigma_1 - \sigma_3) k_z] + \sigma_0 (c_3 k_y + c_1); \\
\Lambda; R_6; & [c_1 + c_2 (k_x + k_y + k_z)] \sigma_0 + \sqrt{3} c_3 \sigma_1 (k_y - k_x) - c_3 \sigma_3 (k_x + k_y - 2 k_z); \\
G; \{R_2, R_4\}; & [c_1 + c_2 (k_x - k_y)] \sigma_0 + (c_3 \sigma_1 + c_4 \sigma_2) (k_x + k_y) + c_5 \sigma_3 k_z; \\
F; R_{12}; & [c_1 + c_2 (k_x - k_y + k_z)] \sigma_0 + \sqrt{3} c_3 \sigma_1 (k_y + k_x) + c_3 \sigma_3 (k_x + k_y - 2 k_z);
\end{aligned}$$

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Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Sigma; \{R_2\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 k_x + c_2 k_y) + \sigma_3 c_3 (k_x + k_y) + c_4 \sigma_1 (k_x - k_y); \\
\Lambda; \{R_3\}, \{R_4\}; & \quad \sigma_0 (c_1 + c_2 q_z) + \sigma_3 c_3 q_z; \\
\{R_3\}, \{R_6\}; & \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z + (A_6 c_4 + 2 A_7 c_5 - A_2 c_6) q_y + [A_4 c_4 + (A_5 - \sqrt{3} A_8) c_5 - A_1 c_6] q_x; \\
\{R_4\}, \{R_6\}; & \quad A_0 (c_1 + c_2 q_z) + (\sqrt{3} A_5 + A_8) c_3 q_z - [A_6 c_4 - (A_5 - \sqrt{3} A_8) c_5 - A_2 c_6] q_x + (A_4 c_4 + 2 A_7 c_5 - A_1 c_6) q_y; \\
D; \{R_5\}, \{R_6\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
\{R_5\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x - k_y); \\
\{R_5\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x + k_y); \\
\{R_6\}, \{R_7\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x + k_y); \\
\{R_6\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z + (c_4 \sigma_1 + c_5 \sigma_2) (k_x - k_y); \\
\{R_7\}, \{R_8\}; & \quad \sigma_0 (c_1 + c_2 k_z) + \sigma_3 c_3 k_z; \\
F; \{R_9\}, \{R_{10}\}; & \quad \sigma_0 (c_1 + c_2 p_z) + \sigma_3 c_3 p_z; \\
\{R_9\}, \{R_{12}\}; & \quad A_0 (c_1 + c_2 p_z) + (\sqrt{3} A_5 + A_8) c_3 p_z + (A_6 c_4 + 2 A_7 c_5 - A_2 c_6) (\sqrt{3} p_x - p_y) + \\
& \quad [A_4 c_4 + (A_5 - \sqrt{3} A_8) c_5 - A_1 c_6] (p_x + \sqrt{3} p_y); \\
\{R_{10}\}, \{R_{12}\}; & \quad A_0 (c_1 + c_2 p_z) + (\sqrt{3} A_5 + A_8) c_3 p_z + (A_4 c_4 + 2 A_7 c_5 - A_1 c_6) (\sqrt{3} p_x - p_y) - \\
& \quad [A_6 c_4 - (A_5 - \sqrt{3} A_8) c_5 - A_2 c_6] (p_x + \sqrt{3} p_y);
\end{aligned}$$

## SG 221

$\Gamma_c; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} \Gamma; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\ R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\ R; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\ R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 (\Gamma_{2,2} k_x + \Gamma_{1,0} k_z); \\ \Lambda; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + c_4 (\Gamma_{2,2} q_y - \Gamma_{1,0} q_x) + c_5 (\Gamma_{2,3} q_x + \Gamma_{2,1} q_y); \\ T; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,2} k_y); \end{aligned}$$

## SG 222

$\Gamma_c; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} \Gamma; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\ R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\ X; \{R_{19}, R_{20}\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x + \Gamma_{3,3} k_z) + k_y (c_3 \Gamma_{1,0} + c_4 \Gamma_{2,0}); \\ \{R_{21}, R_{22}\}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x + \Gamma_{3,3} k_z) + k_y (c_3 \Gamma_{1,0} + c_4 \Gamma_{2,0}); \\ M; R_{19}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x + \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z; \\ R; R_{18}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x - \Gamma_{3,2} k_y + \Gamma_{3,3} k_z); \\ \{R_{21}, R_{22}\}; & c_1 Q_{0,0,0} - 2c_2 Q_{3,1,3} k_z + (c_3 Q_{1,1,3} + c_4 Q_{2,1,3}) k_x + (c_4 Q_{1,1,0} - c_3 Q_{2,1,0}) k_y + \\ & [c_2 k_x (\sqrt{3} Q_{0,2,+} + Q_{3,1,+}) - i c_2 k_y (\sqrt{3} Q_{3,2,+} - Q_{0,1,+}) - c_3 k_z Q_{1,1,+} - c_4 k_z Q_{2,1,+} + h.c.]; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 (\Gamma_{2,2} k_x + \Gamma_{1,0} k_z); \\ \Lambda; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + c_4 (\Gamma_{2,2} q_y - \Gamma_{1,0} q_x) + c_5 (\Gamma_{2,3} q_x + \Gamma_{2,1} q_y); \\ S; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} (k_x + k_z) + (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}) (k_z - k_x) + (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) k_y; \\ Z; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \\ T; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_y - \Gamma_{2,1} k_x); \end{aligned}$$



## SG 223

$\Gamma_c; \{C_{4x}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
X; R_{19}; & c_1 \Gamma_{0,0} + c_2 [\Gamma_{0,2} (k_x + k_z) + \Gamma_{0,3} (k_x - k_z)] + c_3 \Gamma_{3,1} k_y; \\
R; R_{18}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} k_x - \Gamma_{3,2} k_y + \Gamma_{3,3} k_z); \\
\{R_{21}, R_{22}\}; & c_1 Q_{0,0,0} - 2c_2 Q_{3,1,3} k_z + (c_3 Q_{1,1,3} + c_4 Q_{2,1,3}) k_x + (c_4 Q_{1,1,0} - c_3 Q_{2,1,0}) k_y + \\
& [c_2 k_x (\sqrt{3} Q_{0,2,+} + Q_{3,1,+}) - i c_2 k_y (\sqrt{3} Q_{3,2,+} - Q_{0,1,+}) - c_3 k_z Q_{1,1,+} - c_4 k_z Q_{2,1,+} + h.c.];
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 (\Gamma_{2,2} k_x + \Gamma_{1,0} k_z); \\
\Lambda; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + c_4 (\Gamma_{2,2} q_y - \Gamma_{1,0} q_x) + c_5 (\Gamma_{2,3} q_x + \Gamma_{2,1} q_y); \\
S; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} (k_x + k_z) + (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}) k_y + (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) (k_z - k_x); \\
T; \{R_{13}\}, \{R_{14}\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_y - \Gamma_{2,2} k_x);
\end{aligned}$$

## SG 224

$\Gamma_c; \{C_{4x}^+ | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \{I | \frac{1}{2} \frac{1}{2} \frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
X; R_{19}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x + \Gamma_{0,2} k_z) + c_3 \Gamma_{3,1} k_y; \\
M; R_{19}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x + \Gamma_{0,2} k_y) + c_3 \Gamma_{3,1} k_z; \\
R; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)];
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 (\Gamma_{2,2} k_x + \Gamma_{1,0} k_z); \\
\Lambda; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + c_4 (\Gamma_{2,2} q_y - \Gamma_{1,0} q_x) + c_5 (\Gamma_{2,3} q_x + \Gamma_{2,1} q_y); \\
Z; \{R_5, R_8\}, \{R_6, R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \\
T; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + c_4 (\Gamma_{1,0} k_x + \Gamma_{2,1} k_y);
\end{aligned}$$

## SG 225

$\Gamma_c^f; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \{I|000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} \Gamma; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\ R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 (\Gamma_{2,2} k_x + \Gamma_{1,0} k_z); \\ \Lambda; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + c_4 (\Gamma_{2,2} q_y - \Gamma_{1,0} q_x) + c_5 (\Gamma_{2,3} q_x + \Gamma_{2,1} q_y); \end{aligned}$$

## SG 226

$\Gamma_c^f; \{C_{4x}^+|000\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|000\}, \{I|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} \Gamma; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\ R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\ L; \{R_{10}, R_{10}\}; & (c_1 + c_2 q^2 + c_3 q_z^2) \Gamma_{0,0} + c_4 \Gamma_{0,3} q_y (q_y^2 - 3q_x^2) + \sum_{i=1}^3 [q_z (c_{i,1} + c_{i,2} q^2 + c_{i,3} q_z^2) + c_{i,4} q_x (q_x^2 - 3q_y^2)] \Gamma_{i,2}; \\ & \{R_{17}, R_{18}\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} q_y - \Gamma_{0,2} q_x) + q_z (c_3 \Gamma_{1,1} + c_4 \Gamma_{2,1}); \\ W; \{R_6, R_7\}; & c_1 \Gamma_{0,0} + k_x (c_2 \Gamma_{1,2} + c_3 \Gamma_{2,2}) + c_4 [\Gamma_{0,1} (k_z - k_y) + \Gamma_{0,3} (k_y + k_z)]; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 (\Gamma_{2,2} k_x + \Gamma_{1,0} k_z); \\ \Lambda; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + c_4 (\Gamma_{2,2} q_y - \Gamma_{1,0} q_x) + c_5 (\Gamma_{2,3} q_x + \Gamma_{2,1} q_y); \\ Q; \{R_2, R_2\}, \{R_4, R_4\}; & \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} (k_y - k_z) + \Gamma_{1,0} [c_2 k_x + c_3 (k_y + k_z)] + \sum_{i=1}^3 \Gamma_{2,i} [c_{i,2} k_x + c_{i,3} (k_y + k_z)]; \end{aligned}$$

## SG 227

$\Gamma_c^f; \{C_{4x}^+|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \{I|\frac{1}{4}\frac{1}{4}\frac{1}{4}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned} \Gamma; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\ R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\ & c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\ X; R_{19}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x + \Gamma_{0,2} k_z) + c_3 \Gamma_{3,1} k_y; \end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned} \Delta; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 (\Gamma_{2,2} k_x + \Gamma_{1,0} k_z); \\ \Lambda; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + c_4 (\Gamma_{2,2} q_y - \Gamma_{1,0} q_x) + c_5 (\Gamma_{2,3} q_x + \Gamma_{2,1} q_y); \\ Z; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \end{aligned}$$

SG 228

 $\Gamma_c^f; \{C_{4x}^+ | \frac{1}{4} \frac{1}{4} \frac{1}{4}\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | \frac{1}{4} \frac{1}{4} \frac{1}{4}\}, \{I | \frac{3}{4} \frac{3}{4} \frac{3}{4}\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
X; R_{19}; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{0,3} k_x + \Gamma_{0,2} k_z) + c_3 \Gamma_{3,1} k_y; \\
L; \{R_{10}, R_{10}\}; & (c_1 + c_2 q^2 + c_3 q_z^2) \Gamma_{0,0} + c_4 \Gamma_{0,3} q_y (q_y^2 - 3q_z^2) + \sum_{i=1}^3 [q_z (c_{i,1} + c_{i,2} q^2 + c_{i,3} q_z^2) + c_{i,4} q_x (q_x^2 - 3q_y^2)] \Gamma_{i,2}; \\
& \{R_{17}, R_{18}\}; c_1 \Gamma_{0,0} + c_2 (\Gamma_{3,1} q_y - \Gamma_{0,2} q_x) + q_z (c_3 \Gamma_{1,1} + c_4 \Gamma_{2,1}); \\
W; \{R_{20}, R_{20}\}; & (c_1 + c_2 k^2 + c_3 k_x^2) \Gamma_{0,0} + c_4 \Gamma_{0,1} k_y k_z + \sum_{i=1}^3 \Gamma_{i,3} [c_{i,1} k_x + c_{i,2} (k_y^2 - k_z^2)];
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 (\Gamma_{2,2} k_x + \Gamma_{1,0} k_z); \\
\Lambda; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + c_4 (\Gamma_{2,2} q_y - \Gamma_{1,0} q_x) + c_5 (\Gamma_{2,3} q_x + \Gamma_{2,1} q_y); \\
Z; \{R_5, R_7\}, \{R_6, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_x) + \Gamma_{3,0} c_3 k_x + k_y (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) + k_z (c_6 \Gamma_{2,3} + c_7 \Gamma_{1,0}); \\
Q; \{R_{10}, R_{10}\}, \{R_{14}, R_{14}\}; & \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} (k_y - k_z) + \Gamma_{1,0} [c_2 k_x + c_3 (k_y + k_z)] + \sum_{i=1}^3 \Gamma_{2,i} [c_{i,2} k_x + c_{i,3} (k_y + k_z)];
\end{aligned}$$

SG 229

 $\Gamma_c^v; \{C_{4x}^+ | 000\}, \{\bar{C}_{31}^- | 000\}, \{C_{2b} | 000\}, \{I | 000\}, \mathcal{T};$  Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
H; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
P; R_8; & c_1 \Gamma_{0,0} + c_2 (\Gamma_{1,2} k_x - \Gamma_{2,2} k_y - \Gamma_{3,2} k_z);
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 (\Gamma_{2,2} k_x + \Gamma_{1,0} k_z); \\
\Lambda; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + c_4 (\Gamma_{2,2} q_y - \Gamma_{1,0} q_x) + c_5 (\Gamma_{2,3} q_x + \Gamma_{2,1} q_y); \\
F; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 p_z) + \Gamma_{3,0} c_3 p_z + (c_4 \Gamma_{2,2} + c_5 \Gamma_{2,1}) (\sqrt{3} p_x - p_y) - (c_4 \Gamma_{1,0} - c_5 \Gamma_{2,3}) (p_x + \sqrt{3} p_y);
\end{aligned}$$

$\Gamma_c^v; \{C_{4x}^+|00\frac{1}{2}\}, \{\bar{C}_{31}^-|000\}, \{C_{2b}|\frac{1}{2}\frac{1}{2}\frac{1}{2}\}, \{I|000\}, \mathcal{T}$ ; Centrosymmetric; with SOC

$$\begin{aligned}
\Gamma; R_8; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
R_{16}; & (c_1 + c_2 k^2) \Gamma_{0,0} + c_3 [k_x \Gamma_{1,0} (k_y + k_z) + \Gamma_{2,1} k_x (k_z - k_y) - \sqrt{2} \Gamma_{2,3} k_y k_z] + \\
& c_4 [\Gamma_{3,0} (2k_x^2 - k_y^2 - k_z^2) + \sqrt{3} \Gamma_{2,2} (k_z^2 - k_y^2)]; \\
H; R_{18}; & c_1 \Gamma_{0,0} + c_2 (-\Gamma_{3,2} k_x + \Gamma_{3,1} k_y + \Gamma_{3,3} k_z); \\
\{R_{21}, R_{22}\}; & c_1 Q_{0,0,0} + c_2 [(\sqrt{3} Q_{0,1,2} - 3Q_{3,2,2}) k_x + \sqrt{3} (2Q_{3,1,3} k_z - Q_{3,1,1} k_y) - 3Q_{0,2,1} k_y] + \\
& c_3 (Q_{1,1,0} k_x + Q_{2,1,3} k_y - Q_{2,1,1} k_z) + c_4 (Q_{2,1,0} k_x - Q_{1,1,3} k_y + Q_{1,1,1} k_z); \\
\{R_{27}, R_{28}\}; & c_1 S_{0,0} + c_2 (S_{0,6} k_x + S_{0,4} k_y - S_{0,7} k_z) + c_3 (S_{1,2} k_x - S_{1,1} k_y + S_{1,3} k_z) + c_4 (S_{2,2} k_x - S_{2,1} k_y + S_{2,3} k_z); \\
N; \{R_{13}, R_{14}\}; & c_1 \Gamma_{0,0} + c_2 \Gamma_{0,2} (k_x - k_y) + (c_3 \Gamma_{1,1} + c_4 \Gamma_{2,1}) (k_x + k_y) + c_5 \Gamma_{3,1} k_z;
\end{aligned}$$

Accidental degeneracies on high symmetry line

$$\begin{aligned}
\Delta; \{R_6\}, \{R_7\}; & \Gamma_{0,0} (c_1 + c_2 k_y) + \Gamma_{3,0} c_3 k_y + c_4 (\Gamma_{2,2} k_x + \Gamma_{1,0} k_z); \\
\Lambda; \{R_3, R_4\}, \{R_6\}; & \Gamma_{0,0} (c_1 + c_2 q_z) + \Gamma_{3,0} c_3 q_z + c_4 (\Gamma_{2,2} q_y - \Gamma_{1,0} q_x) + c_5 (\Gamma_{2,3} q_x + \Gamma_{2,1} q_y); \\
D; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} (c_1 + c_2 k_z) + \Gamma_{3,0} c_3 k_z + (c_4 \Gamma_{1,0} + c_5 \Gamma_{2,3}) (k_x - k_y) + (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) (k_x + k_y); \\
G; \{R_5, R_6\}, \{R_7, R_8\}; & \Gamma_{0,0} c_1 + \sum_{i=0,3} \Gamma_{i,0} c_{i,1} (k_x - k_y) + (c_2 \Gamma_{1,0} + c_3 \Gamma_{2,3}) (k_x + k_y) + (c_4 \Gamma_{2,1} + c_5 \Gamma_{2,2}) k_z; \\
F; \{R_9, R_{10}\}, \{R_{12}\}; & \Gamma_{0,0} (c_1 + c_2 p_z) + \Gamma_{3,0} c_3 p_z + (c_4 \Gamma_{2,2} + c_5 \Gamma_{2,1}) (\sqrt{3} p_x - p_y) - (c_4 \Gamma_{1,0} - c_5 \Gamma_{2,3}) (p_x + \sqrt{3} p_y);
\end{aligned}$$

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